the OIL AND GAS JOURNAL

PUBLISHED WEEKLY FEBRUARY 1, 1960

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STATISTICS
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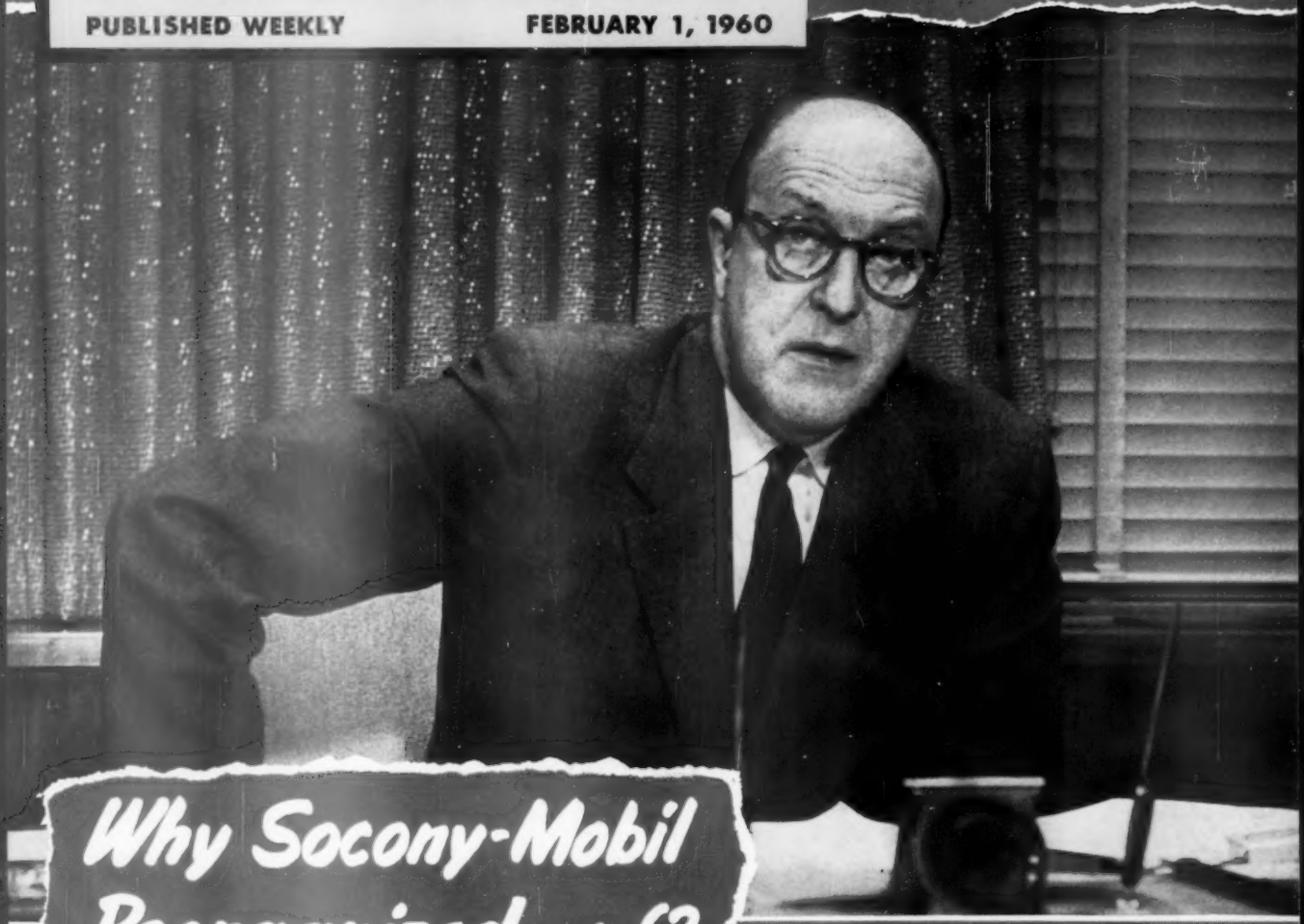

Why Socony-Mobil Reorganized...p.62

...an interview with Mobil Oil Co. President Herbert Willetts

Look for new round of attacks on marketing ▸ 59

How Richfield reduced cat cracker feed contamination ▸ 86

Investment of $306 ups plant revenue $12,000 per year ▸ 125

ON COURSE

Marine rig operators everywhere have long recognized the merits of the *full scope of services* offered by Halliburton.

Halliburton service is the "course" to follow when you require the best in cementing, testing, fracturing, special tools and many other oil field specialty services.

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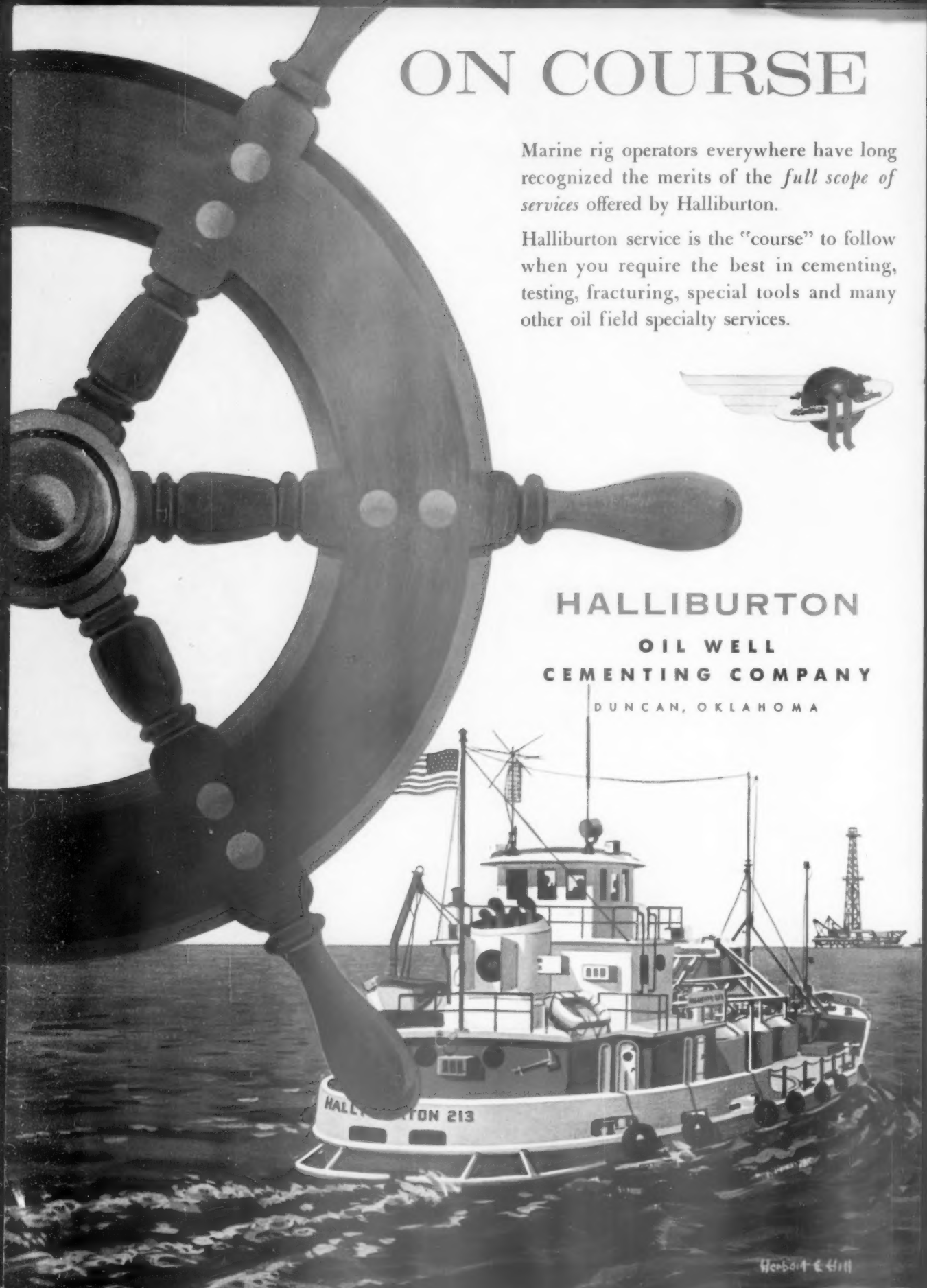

OIL AND GAS JOURNAL
Vol. 58 No. 5

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Annual index available on request.

TECHNOLOGY—OPERATION

Refining-Processing

How Richfield Reduced Cat Cracker Feed Contamination 86

By E. C. Herthel, E. H. Reynolds, and J. H. Roe

By reducing nickel content in feed stock, Richfield Oil Corp. has greatly improved cat cracker operations. While other metal contaminants have an adverse effect on catalyst selectivity, nickel is by far the most serious. The reduction in metals was accomplished by improved fractionation in the vacuum-distillation unit.

Nelson Refinery Cost Indexes 100

Survey of Petrochemical and Field-Processing-Plant Construction .. 111

At least 70 petrochemical construction projects are planned or under way in the U. S. and Canada, including 14 new projects for production of polyethylene and polypropylene facilities. Some 25 field-processing construction projects are planned or under way in the U. S. and Canada.

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Demonstration of pressure principles.

Semiautomation of Deethanizer Improves Gasoline Plant Operation . 125

By Stewart E. Young

Simple instrumentation costing $306.25 results in closer control of specifications, safer vapor-pressure propane, and increased revenue of $12,000 per year at Pan American Corp.'s South Fullerton gasoline plant. Bottom temperature of the deethanizer column is controlled by variations in the specific gravity of the feed.

Process Costimating—65 129

Operating costs in catalytic cracking.

Drilling-Production

Can You Use These Drilling Ideas? 90

Herndon Drilling Co.'s No. 5 rig operating in southern Illinois and Hallmark Petroleum & Drilling Co.'s No. 5 rig operating in Kay County, Oklahoma, have instituted a number of time-saving ideas.

Lake Maracaibo Has a New Floating Power Plant 92

By S. P. Stone and P. R. Beard

Featuring a gas-turbine drive, this barge-mounted generating station will develop 15,000 kw. of electrical energy. The unit is completely self-contained on a steel barge 50 by 200 ft. The generating system may be controlled from aboard the barge or from a remote location, and the entire unit may be moved to any location on the lake to provide electric power in an emergency.

Reservoir Engineering—No. 19 96

By. E. T. Guerrero and F. M. Stewart

How to obtain a k_g/k_o curve from laboratory unsteady-state flow measurements.

Pipelining

How Panhandle Eastern Combated Five Common Cooling-Water Problems 101

By J. T. Russell

Water treatment using automatically controlled sulfur burners at eight installations for as much as 7 years has been successful. Annual savings in treatment costs are approximately 50% of the cost of the units which require only periodic attention. Water testing by plant personnel is not required. The equipment is simple and economical.

Effect of Detergent Oils on Corrosion 132

By D. V. Kniebes

As a result of spectrographic analyses, it may be possible to set up recommended specifications for maximum allowable contaminant concentration in nondetergent lube oils of compressor engines. Part 3 of three parts.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Feb. 1, 1960

Cost cutting is paying off in brighter oil profits:

Early reports on 1959 business record good gains in net return for individual companies.

The reason: Record petroleum sales, lower costs, and more efficient use of facilities.

Jersey Standard's sales topped $8 billion for the first time. The sales increase was 7½% but the increase in net profit was even better—11%. The net was $626 million or $2.91 a share compared with $562.5 million and $2.72 in 1958.

President M. J. Rathbone attributes good showing to overall company efficiency, a growing sales volume especially in petrochemicals.

Phillips had a record net of $104 million or $3.03 a share in 1959, a 23% gain over a year ago.

President K. S. Adams gives this reason: Higher sales of all products, continued reduction of unit operating costs, returns from special investment projects made in the past.

His forecast: Another record year in 1960. Benefits of company diversification will continue to bear fruit.

Shell's net income reached $147 million compared with $128.6 million in 1958. Per share earnings were $2.43 and $2.12 respectively.

▼ ▼ ▼

Political spotlight is now on oil marketers.

Three bills introduced by Rep. James Roosevelt dealing with retail marketing of petroleum products would:

...Prohibit a refiner who sells products at wholesale from selling at retail or owning retail stations. This is the "complete divorcement" bill.

...Prohibit refiner from acting as agent or receiving commission on any TBA items to be sold through his stations. This is the TBA divorcement bill.

...Require all service station leases to be filed with the FTC.

The bills apply only to integrated companies, would not restrict jobbers or independent marketers.

Washington sources rate prospects dim for the bills being passed this session. They are a rallying point, however, for groups interested in attacking the oil industry. Oil men must be ready to defend against them.

Another move to watch: A hike in minimum wages.

Senator Kennedy is sponsoring a bill to increase wages to $1.25 per hour. It's a mandatory increase and would extend to many types of businesses not now covered. Included in this group would be service stations of oil companies marketing in more than one state.

The 11-year-old antitrust suit against Texaco will be tried starting June 21 in San Diego. Texaco has elected to fight the charges of marketing violations alone after seven other major defendants settled by consent decree.

▼ ▼ ▼

Louisiana's two top oil officials may step down—but not because of the recent gubernatorial election.

Conservation Commissioner Ashton Mouton is debating whether to resign and run for mayor of Lafayette.

William G. Helis, chairman of the state mineral board, has considered giving up his part-time post for personal reasons.

Helis was a strong backer of Jimmy Davis, who won the democratic nomination for governor over his runoff opponent, De Lesseps Morrison.

The oil industry in general backed Davis in the voting and no important changes in conservation and allowables rules are expected following Davis' victory.

▼ ▼ ▼

Record price has been paid to Gulf and Tidewater for one trillion cubic feet of gas on the Gulf Coast.

United Gas Pipe Line paid initial price of 22½ cents an M.c.f. plus full tax reimbursement. This pushes gross price up to 24.8 cents. Well-head price escalates to 25 cents in 1962 (p. 61).

FPC is falling further behind in handling independent producer rate cases and certificate filings.

The FPC's year-end report shows that at the end of 1959 the commission had 3,065 rate cases pending compared with 2,034 at the end of 1958. On independent producer certificate filings, 2,659 are still pending compared with 2,024 last year.

Another clue to the growing backlog: FPC received 2,104 rate increase filings during 1959, disposed of 240.

In this connection, two appeals were made last week

for legislation clarifying natural-gas regulations. The IPAA plans to press for a law freeing gas producers from price regulations. The FPC proposes a variety of changes (p. 76).

▼ ▼ ▼

Activity in Alaska:

Alaskan Oil & Mineral has suspended operations at the 1 A Zappa and 1 Beal in Iniskin Bay.

The Benedum syndicate 1 Nulato wildcat is being drilled ahead below 2,800 ft. Drilling is slow in the severely faulted formations being encountered.

California Standard has abandoned its seventh well in Swanson River Unit at 11,774 ft. Well was plugged back to 4,705 ft., and from there a directional well is being drilled to an adjoining quarter section.

Another leasing boom is predicted by Commissioner of Natural Resources Phil R. Holdsworth if Congress passes a bill to double acreage limitations on oil leases.

▼ ▼ ▼

Around the industry:

Idea of universal credit card for oil products is being given careful study by oil management. So far 16 companies are considering the plan of Oil Services Credit Corp. Others will get a chance soon...All Sunoco service stations are now honoring Hilton Carte Blanche credit cards, a move for outside gasoline business.

Esso Research has a management assistant whose responsibility is to devise and coordinate ways to improve efficiency and cut costs.

Flu epidemic in California has sent absenteeism in oil company offices up to as high as 10%.

Oil men must invest about $120,000 per worker, according to latest statistics of the National Industrial Conference Board. This is more than three times the investment in tobacco, second highest at $35,386 per worker. Average for all manufacturing is $15,886 per worker.

One result of Socony Mobil reshuffle: Robert L. Minckler, senior vice president of Mobil Oil and former president of General Petroleum, will retire about midyear.

He chose retirement rather than leave the West Coast to take an executive post with Mobil in New York.

For a full explanation of the reasons behind Socony's reorganization see p. 62.

Sohio is closing down its Northwest Division office in Bilings, Mont. It's part of a general efficiency and cost-cutting program in Sohio's exploration effort. The company's exploration and production headquarters will remain at Oklahoma City. Most of the Billings employes will be transferred to other areas.

Looking ahead:

First Spraberry waterflood operation will start on one unit this summer with two more in business before the year is over (p. 68).

Offshore California lease will be tested this year by syndicate of Texaco, Monterey, and Newmont. They paid $23.7 million for the 3,840-acre tract off Santa Barbara County. Meanwhile, more acreage in area may be open (p. 78).

Move toward 320-acre spacing—tops in U. S. for primary oil recovery—has been made in North Dakota.

The state industrial commission approved a request by Shell for the wide pattern in Rough Rider field for a year. Field lies in the Dakota badlands where drilling is tough and expensive (OGJ, Jan. 25, p. 121).

Very important is commission's explanation for order. Its aim: To drain efficiently the recoverable oil, assure orderly and uniform development, avoid unnecessary wells, and prevent waste. It held that previous spacing practices in a less enlightened era should not be allowed to prevent the application of new knowledge now available.

▼ ▼ ▼

Shortages of naphthalene are expected to continue until midyear at least.

Supply of this key raw material became critically short during the steel strike. It is primarily derived from coal tar and is an important chemical intermediate for manufacture of phthalic anhydride.

The big demand for naphthalene is prompting several oil processors to take another look at feasibility of producing the chemical. Ashland already has plans to build a 50-million plant at Buffalo, N. Y.

▼ ▼ ▼

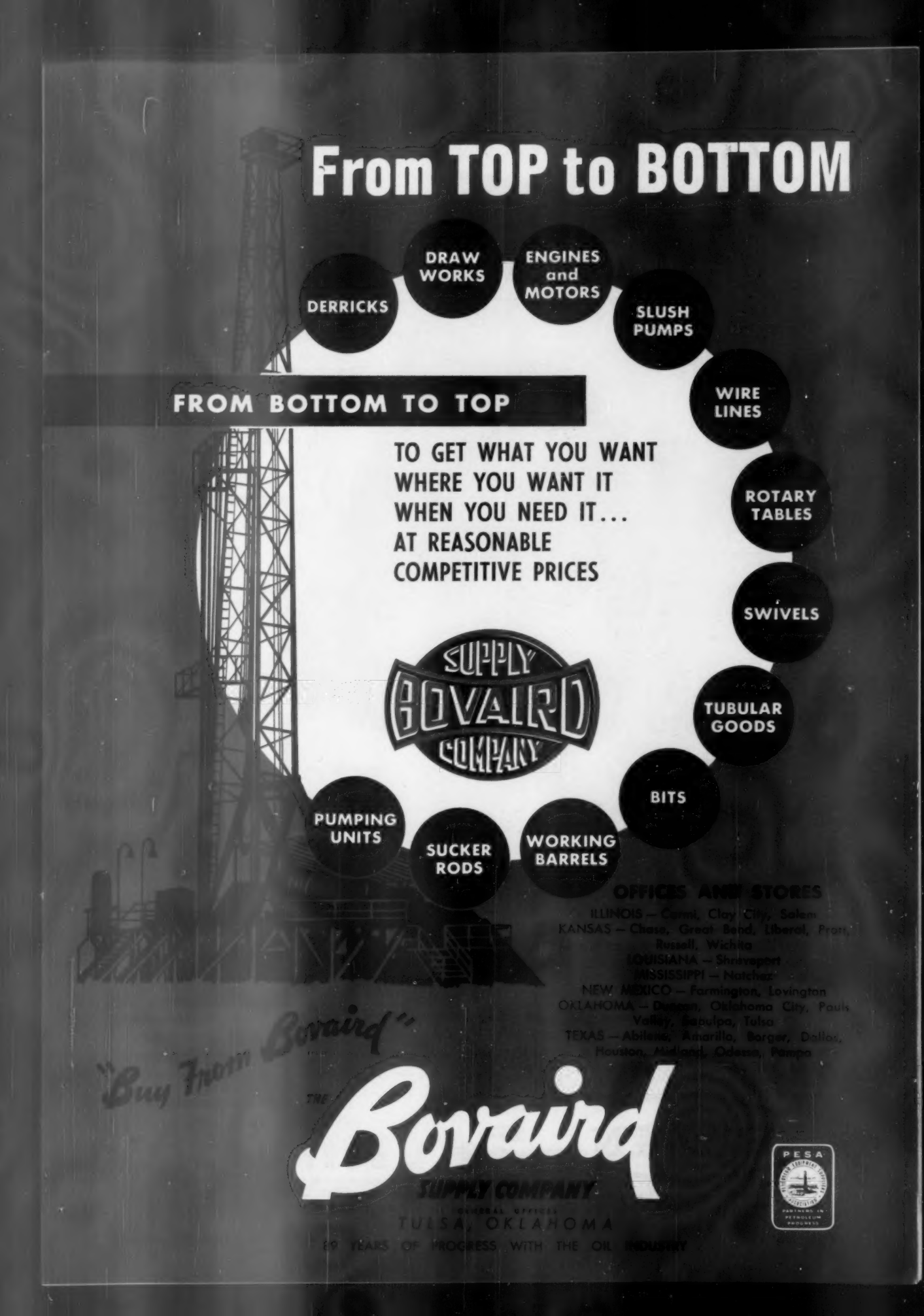
Expect hearings through February by Canada's National Energy Board now looking into gas export applications which would move fuel into the U. S.

The board is subjecting each of the five companies applying for permits to very careful examination on reserves and pricing policies.

Board position apparently is that with such a valuable natural resource at stake careful appraisal is mandatory. Also, oil men feel that the board's technical staff is using the hearings to gain knowledge of the technology and economics of the petroleum industry.

Real dilemma of the board: Fear U. S. market will be so attractive it will pull away gas needed in Canada. Gas producers in Canada deal with Canadian distributors on firm, 20-year price contracts. Their long-term contracts with U. S. distributors include price escalation clauses.

From TOP to BOTTOM



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NEW MEXICO — Farmington, Lovington
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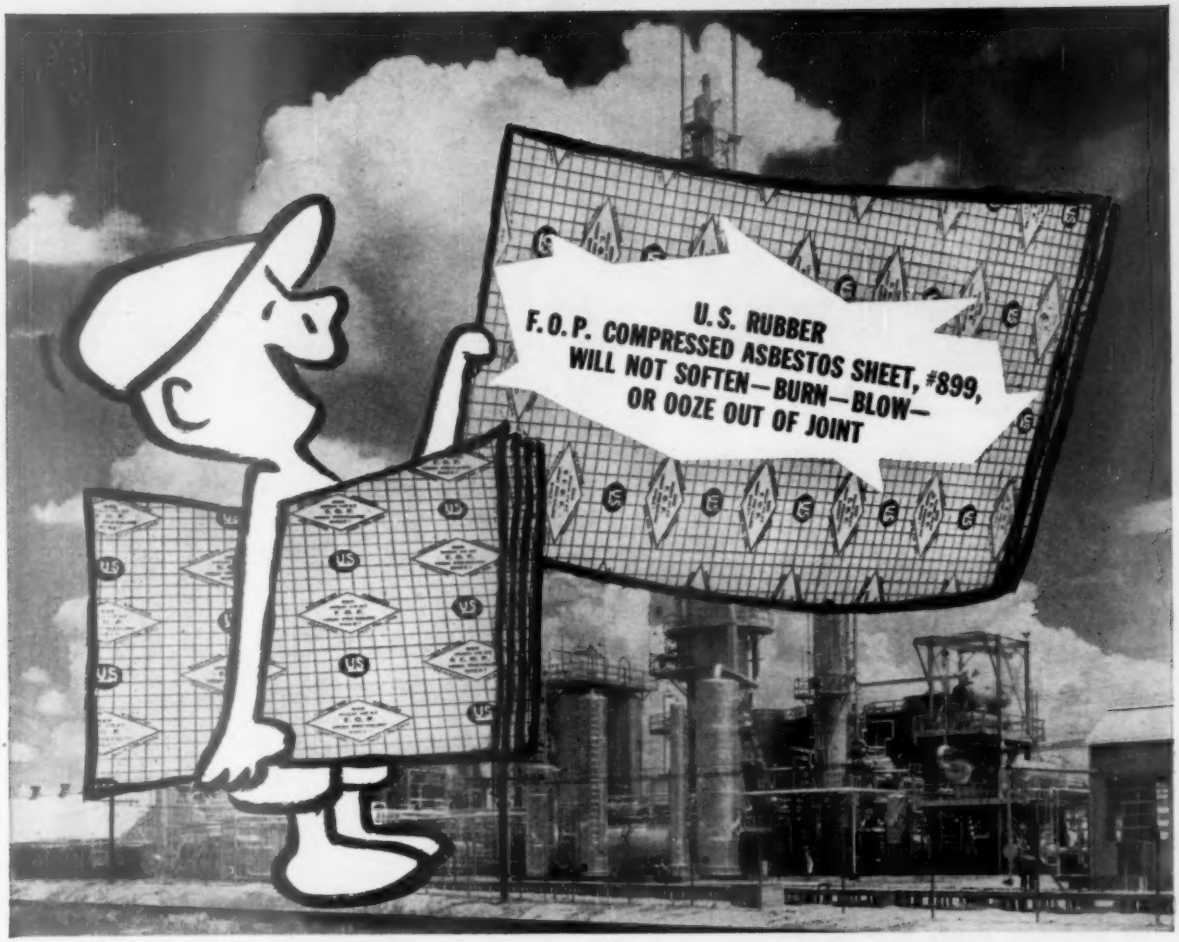

This is the packing that's making headlines where the going's the hottest . . . where flanges or joints must be packed against superheated or saturated steam, air, water, ammonia, gases, oil, gasoline and many chemicals.

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Four of eight 6" stroke pumps operating in the Steamboat Butte plant of British-American Oil Producing Company in Wyoming.

Here's recorded performance of 8 "Oilwell" Water Injection Pumps . . . on the job 5 years!

THE British-American Oil Producing Company has eight "Oilwell" Triplex Plunger Pumps in its pressure-maintenance plant at Steamboat Butte, Wyoming. These pumps have been in operation for five years . . . and their cost-and-service record is outstanding.

These pumps have injected over 37,000,000 barrels of water at pressures from 560 psi to 735 psi with no major pump repairs. Total maintenance during the five years of operation has amounted to 0.09 mills per barrel. On six pumps, valves and seats required replacement; on two pumps, scored plungers were replaced; and certain packing and oil seals have been replaced. Stainless steel valves and seats, installed as original equipment in two pumps, are still in service after five years.

Excellent care and supervision in maintaining prope. operating conditions have contributed to the economical functioning of the pumps.

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Average downtime per pump—
4.2 hours per year

Average parts cost per pump—
$86.14 per year

Here are the detailed facts:

Repair parts for five years	$ 3,445.50
Average repair parts per pump	$ 430.69
Average repair parts per pump per year	$ 86.14
Total downtime in five years	168 hours
Average downtime per pump	21 hours
Average downtime per pump per year	4.2 hours

Your "Oilwell" representative can give complete information on these or other plunger pumps which can give you similar service in waterflood applications. Be sure to contact him while your project is in the planning stage. His application experience will be helpful.

Exterior view of the Steamboat Butte plant.

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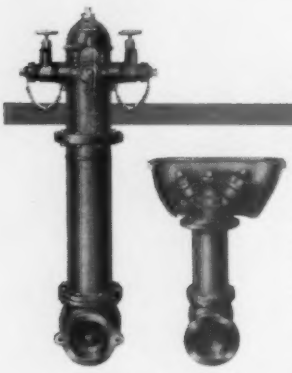
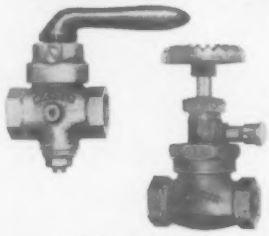
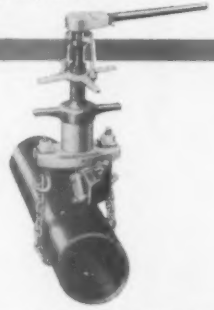


FIRE HYDRANTS

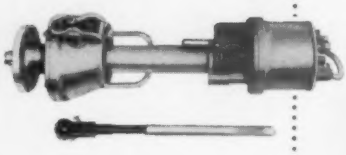
CHECK VALVES



PLUMBING VALVES

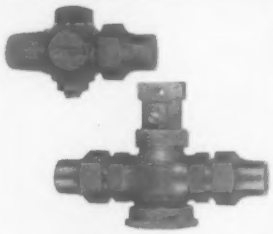


TAPPING MACHINES



DRILLING MACHINES

GATE VALVES



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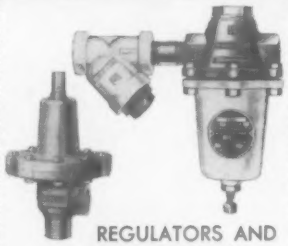

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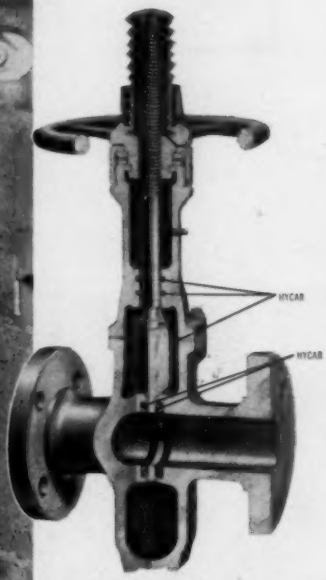
Mueller Co. also makes a full line of No-Blo® products for the petroleum and gas distribution industry.

News about

B.F.Goodrich Chemical *raw materials*



Pressure sealing gate valve manufactured by W-K-M Division of ACF Industries, Inc., Houston, uses Hycar seals and "O" rings. Valves are being manufactured in sizes up to 30" for pipe line use. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

Two hardnesses of Hycar let valve seal both up- and down-stream

A unique seat design for these pressure sealing gate valves uses a soft compound of Hycar nitrile rubber bonded to the back of each metal seat. A tougher, even more highly abrasive-resistant Hycar compound is used on the front of each seat.

Both compounds provide resistance to hydrocarbons and oil field chemicals. The manufacturer reports successful results from tests on crude, gasoline, butane, propane, methane, alkaline solutions and kerosene.

In addition, a combination seal ring made of Hycar and steel is used at the bonnet-body connection. Hycar "O" rings are used for stem packing. They were subjected to as many as 60,000 cycles in lab tests with no sign of leakage.

Hycar nitrile rubber may be the material that will help you get more results for your operation. For more information, write Dept. FH-1, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada, Kitchener, Ontario.

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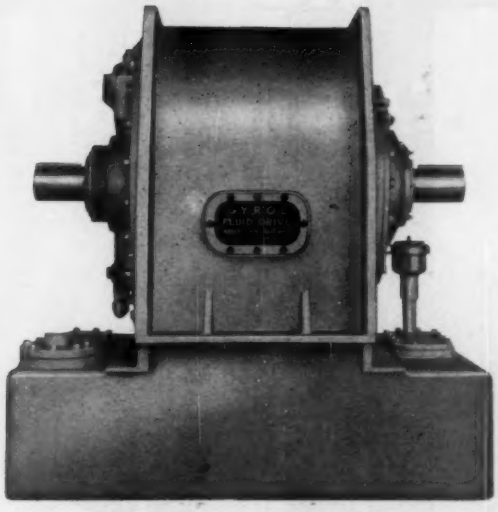

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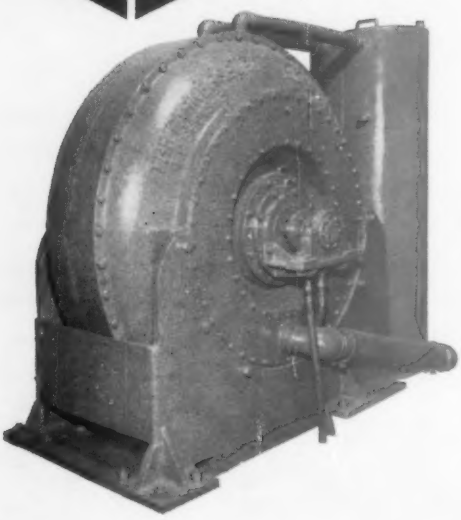
In '58 as in '38 . . . . . A Parkersburg Hydromatic Brake Helped Set a Record for the WORLD'S DEEPEST WELL

Twenty-two years ago, the deepest well in the world was 15,004 feet, drilled by Continental Oil in Kern County, California. A Parkersburg Hydromatic Brake helped set this depth record. Today's deepest well, drilled another 10,336 feet by Phillips in Pecos County, Texas, also had a Parkersburg Hydromatic Brake as an integral part of the drawworks.

Hydromatic Brakes have been specified as standard equipment by major drawworks manufacturers since 1931. Whatever your drilling depth, 2,000 feet or 25,000, be sure your drilling rig is equipped with the Parkersburg Hydromatic Brake. You'll save time — and money.



THE PARKERSBURG RIG & REEL COMPANY
Division of Parkersburg-Aetna Corp.
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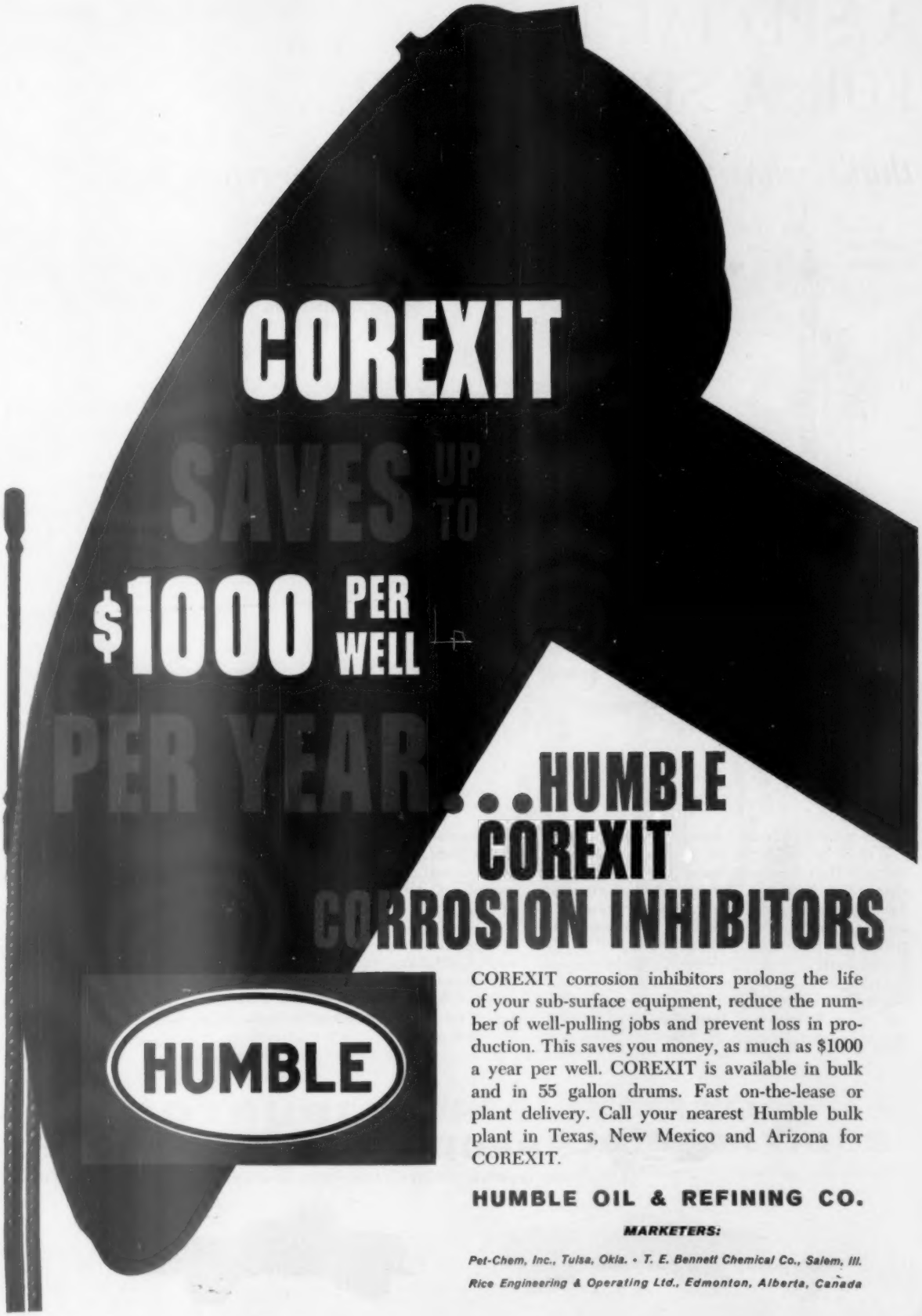


COREXIT corrosion inhibitors prolong the life of your sub-surface equipment, reduce the number of well-pulling jobs and prevent loss in production. This saves you money, as much as $1000 a year per well. COREXIT is available in bulk and in 55 gallon drums. Fast on-the-lease or plant delivery. Call your nearest Humble bulk plant in Texas, New Mexico and Arizona for COREXIT.

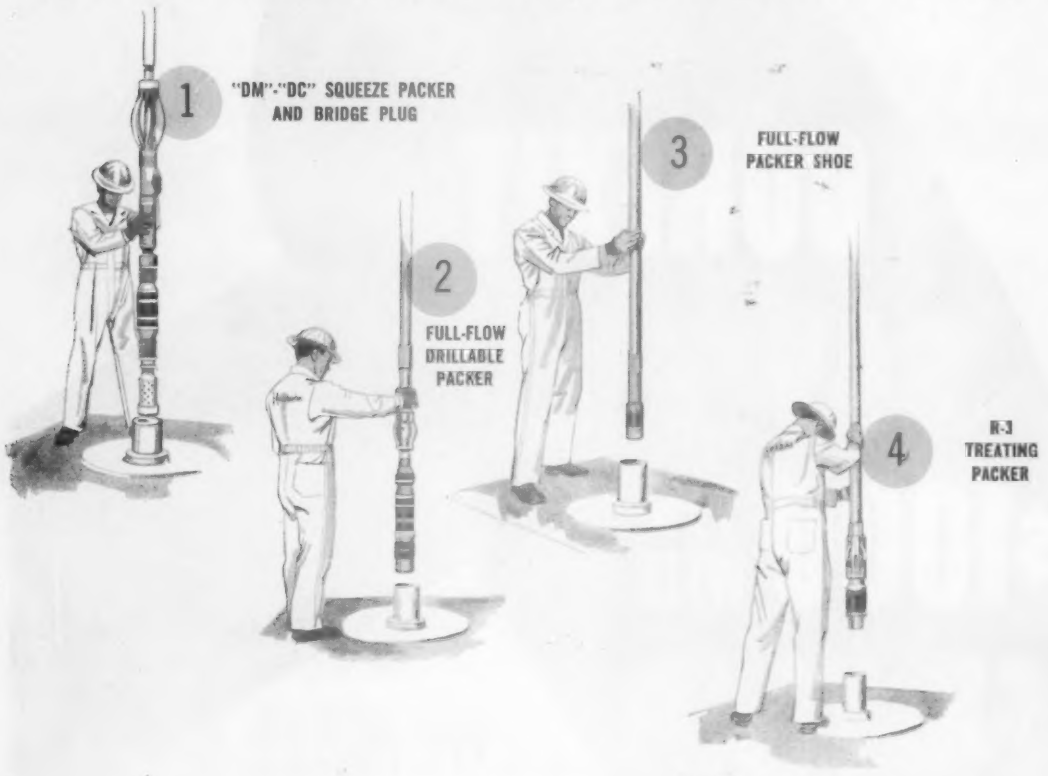
HUMBLE OIL & REFINING CO.

MARKETERS:

Pet-Chem, Inc., Tulsa, Okla. • T. E. Bennett Chemical Co., Salem, Ill.
Rice Engineering & Operating Ltd., Edmonton, Alberta, Canada

A SPECIAL TOOL FOR A SPECIAL JOB...

that's what makes Halliburton Well Services better!



For maximum results, every well service operation must be performed by the tool best suited to the job. Halliburton Special Tools for Squeeze Cementing, Treating, Testing and Production are designed for the best performance wherever it is necessary or desirable to confine pressure to a section of the well bore or cased hole.

Halliburton Tool Development Engineers have the assignment of designing the Special Tools required to make the world's best oil well service *still better*. By means of their unmatched research, design and development, Halliburton offers a complete line of unequalled packers and auxiliary tools that provide superior well services, for faster, more effective, less costly treatments... both routine and special... that will aid in more profitable operation of your well.

Whether you are an operator in the Mid-Continent, Gulf Coast, California, Pennsylvania—or anywhere else in the world of oil... whatever your well conditions... for Special Tools that do the job better, rely on the Halliburton "three million service job experience."

HALLIBURTON
SPECIAL TOOL SERVICES
HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"284 Service Centers—Just Minutes Away from Your Wells"

SOME ADVANTAGES
OF THESE HALLIBURTON SPECIAL TOOLS...

"DM"-"DC" SQUEEZE PACKERS AND BRIDGE PLUGS

Halliburton "DM"-"DC" Drillable Squeeze Packers are specially designed for squeeze cementing . . . Dependable and easy to set on drill pipe, tubing, electric wire line, or sand line . . . engineered to provide a positive fluid "shut-off" from either direction, regardless of depth and pressure. May be used as a Bridge Plug when a Sealing Plug or Ball is dropped or pumped in place after Packer is set, or sealing plug may be installed before tool is run.

FULL-FLOW DRILLABLE PACKER

An economical, full-opening drillable packer, designed especially for formation fracturing when set in either casing or hard uncased formation near to true bit size with pressures to 3,500 psi below the packer. Particularly effective when used with full-opening tubing check valve, as an open hole packer in gas wells with one or more pay sections treated separately and with no fluid load in the annulus on top of the packer.

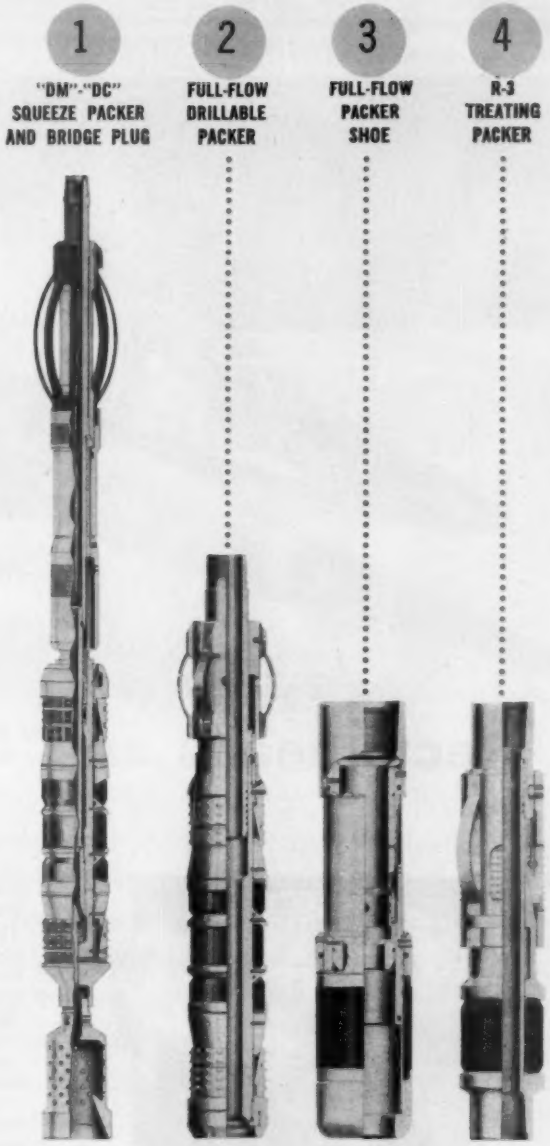
FULL-FLOW PACKER SHOE

The Full-Flow Packer Shoe was designed and built to meet the need for a packer-type cementing shoe to help protect the formation below while cementing tubing or casing in new or old uncased wells. No internal parts remain in the string to be drilled out upon completion of the cementing operation. For old wells to be fractured or treated where no casing is in the hole, tubing or casing is first cemented, well fractured afterward.

R-3 TREATING PACKER

The Halliburton R-3 Treating Packer is a short, compact, full opening retrievable type packer, designed to be run on tubing into a cased hole to isolate a section to be treated, fractured, waterflooded, or produced. Can be set in tension or compression without modification.

This economical packer consists of a packer rubber, conical wedge, drag springs and mechanical type slips mounted in a sleeve, and a J-slot locking arrangement. A full opening mandrel permits passage through the tool of any equipment that will pass through the tubing on which it will ordinarily be run. May be set and reset on one trip in hole, or used from well to well.



HALLIBURTON
SPECIAL TOOL SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

"284 Service Centers—Just Minutes Away from Your Wells"

Like the Convair B-58 *Hustler*

Rectorheads are *"Sealed With Steel"*

Today's modern jet planes that streak across oceans and continents at supersonic speeds, are engineered to withstand tremendous heat, violent stress and extreme temperature variants.

The same welding principle that insures strength and durability in the Hustler by Convair, is utilized in Rector's "Sealed With Steel" casing heads to insure trouble-free completions for all types of oil and gas wells. Rector casing heads are built to withstand fire, shock and highest wellhead pressures. The maintenance-free welded seal, pioneered by Rector has proven its soundness and complete efficiency of application and service in over 100,000 trouble-free field installations.

Whatever your requirements, see your Rector representative or consult your favorite supply store today.

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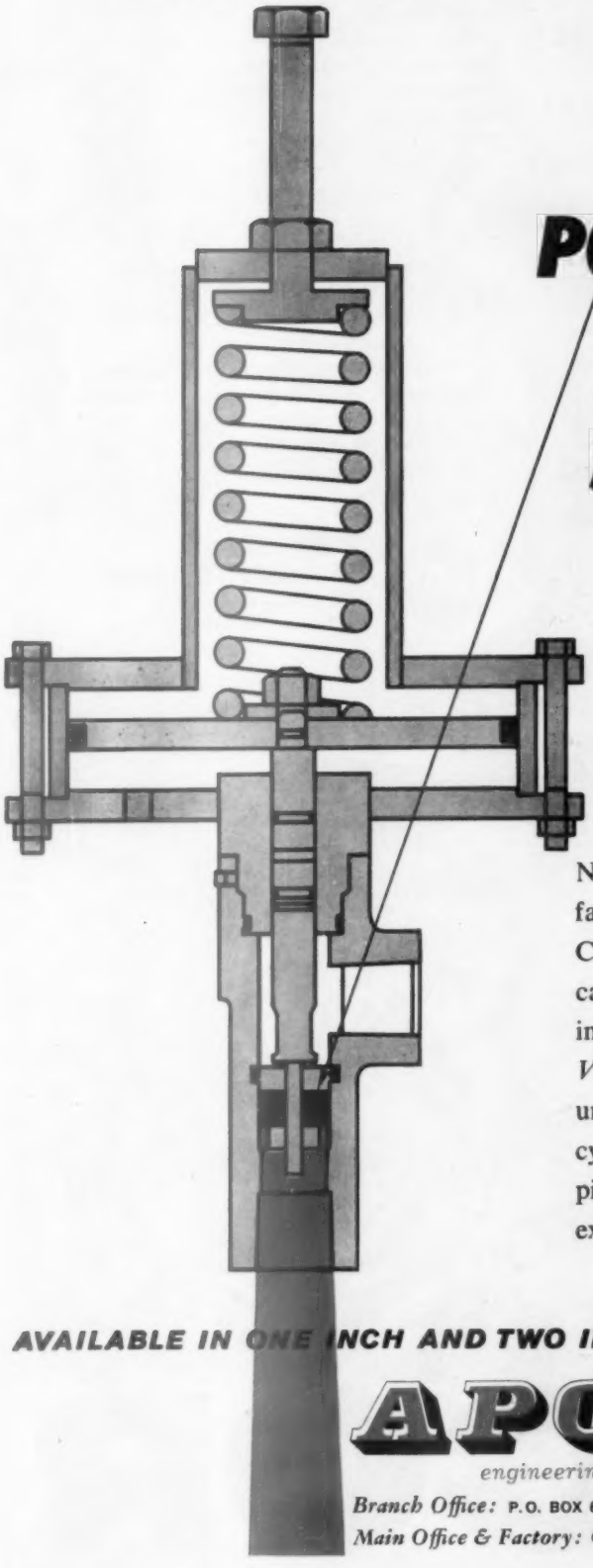
EXPORT REPRESENTATIVES: Continental-Emsco Co., Mid-Continent Supply Co., Oilwell Division of United States Steel Corporation

Here's a liquid dump valve with...



POSITIVE SHUT OFF *that* **STOPS LEAKAGE**

The Check-Stream DUMP VALVE

Now you can stop leakage, the major cause of failure in conventional dump valves, with the new Check-Stream Dump Valve. Even the smallest leak can cause an erosive action that can ruin your valve in a very short time. *The Check-Stream Dump Valve gives positive shut off* . . . it will not leak even under the most severe conditions. A solid rubber cylinder, expanded against the body liner by a piston motor, provides positive shut off as well as extremely fine throttling action.

AVAILABLE IN ONE INCH AND TWO INCH SIZES

Write today for Bulletin 25 giving complete specifications on the Check-Stream Dump Valve.

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now... longer life, improved performance for pipelines, crude units... with Unicor

Are you aware of the tremendous difference a small amount of Unicor can make in pipelines and crude units?

This film-forming, oil-soluble inhibitor prevents all kinds of corrosion. Wherever Unicor has plated out on a surface, it gives protection to tanks, vessels and pipelines whether full, part-full or empty.

By adding a small amount of Unicor to your product—10-20 parts to a million—you prevent product contamination, profit-robbing corrosion; assure maintenance of full-flow capacity and output.

Furthermore, use of Unicor substantially reduces filter cleaning and replacements, scraping operations, power costs and expensive downtime.

What Unicor does for tanks and pipelines it also accomplishes in crude units and other refinery equipment. For detailed information, write to our Products Department.

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"No other valve gives such a perfect seal"

W-K-M Recessed Body Valves feature through-conduit gate construction, pressure seal bonnets, super-finished stems supported on roller bearings — and can be overhauled on-the-line.

Sizes: 1½", 1¾", 2", 2½" and 3". **Working Pressures:** 2000 through 5000 pounds.

PRODUCT OF W-K-M's *Creative Engineering*

W-K-M® Recessed Body Valves for Multiple Completions

No other valves give you such tight sealing, such dependable control.

W-K-M's Controlled Force Seating creates an initial bubble-tight seal between the gate and Teflon inserts. As the gate assembly expands, a tight metal-to-metal seal is achieved. Result: a perfect *Double Tight Seal* without body or seat lubrication.

Next time — and every time — specify W-K-M! Recessed Body Valves are available for dual and triple completions. *At leading supply stores everywhere.*

WRITE FOR CATALOG 200

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DIVISION OF ACF INDUSTRIES INCORPORATED
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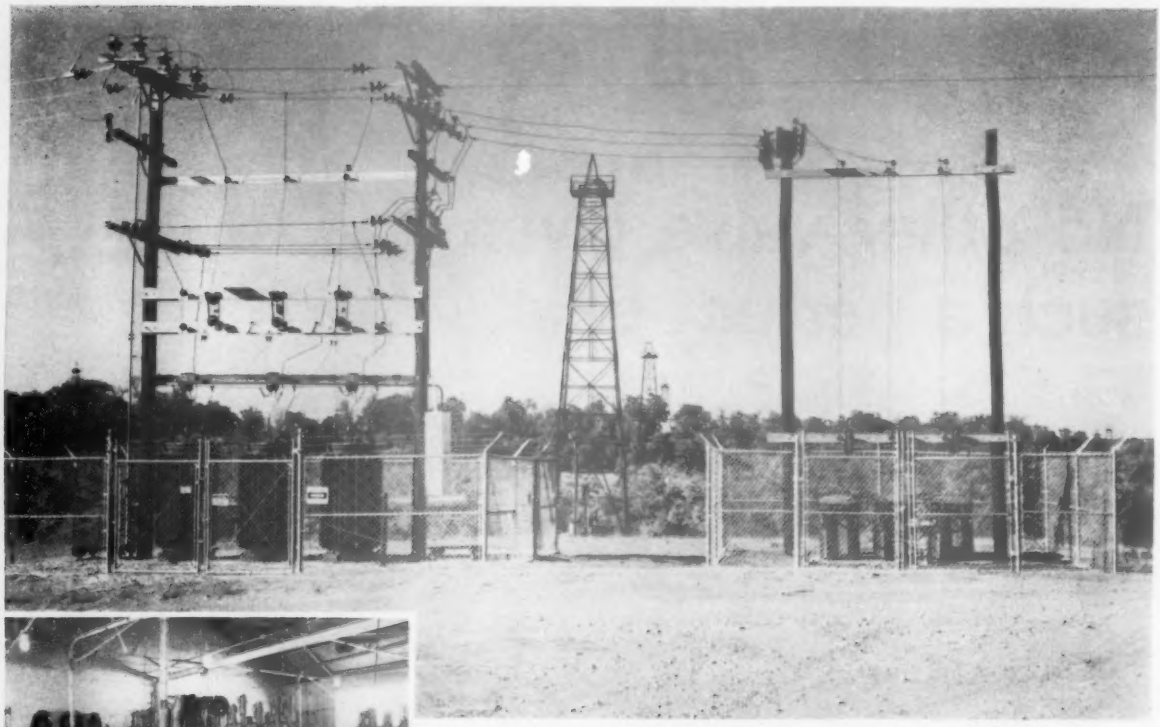
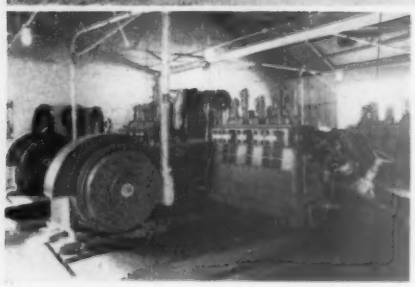
5906-R

You can depend on purchased electric power for

VERSATILITY



Substation for purchased electric power on waterflood project.



Substation above supplies current for these two big electric motors driving pumps for waterflood project.

Purchased Electric Power . . . saves money, manpower, maintenance, and serves you better automatically

The versatility of utility electric power makes it ideal for many types of application in production, pipelines or refineries.

The modern trend to automation and remote control is made easier with versatile purchased electric power. Whatever your particular power requirements are, you will usually find an economical answer to your problems with purchased power. Why not call your nearest utility electric power company today for possible assistance.

Petroleum Electric Power Association

P. O. BOX 35006, DALLAS 35, TEXAS

The **O·C·T**

U-65

has what you need in a . . .

TUBING HANGER

For dual or triple completions, the O-C-T U-65 Tubing Hanger has no peer in the number of advantages offered—in mechanics, economy and safety. This component part of the O-C-T Universal Tubing Head allows all strings of tubing to be raised simultaneously at completion.

But, other advantages are major. Check them:

- Simple, direct setting procedure
- Need for sleeve valves eliminated
- Completion is with tree in place
- Flange connections can be field-tested
- Complete range of sizes, working pressures

LOOK TO O-C-T FIRST FOR WELLHEAD EQUIPMENT. YOU NEED LOOK NO FURTHER.

where progress is a daily practice

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OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

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P. O. Box 3091, Houston, Texas.

"Born in Freedom — Working For Progress"

"This is the slogan adopted for oil's centennial year. It describes our industry well. Probably no other industry can boast the freedom for individual opportunity offered by the petroleum business.

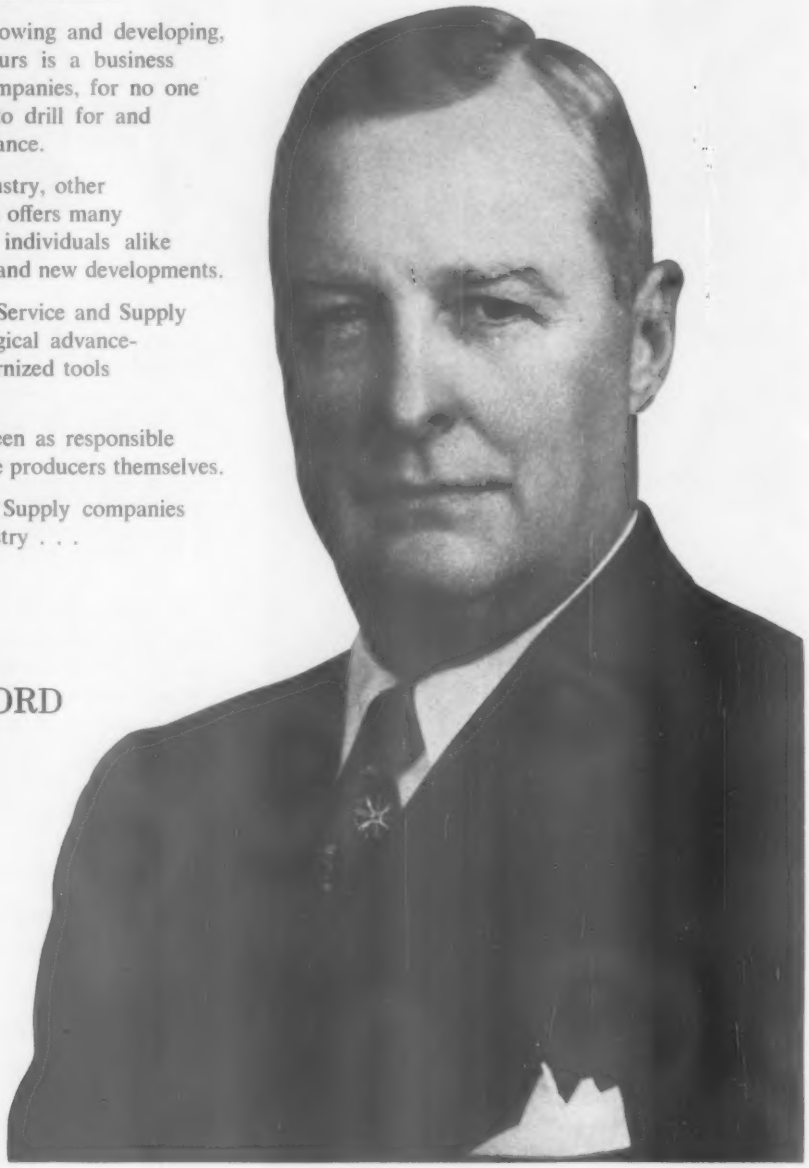
"Ours is a young business, still growing and developing, still inventing and progressing. Ours is a business comprised of many and varied companies, for no one producer is self-sufficient enough to drill for and produce oil and gas without assistance.

"Just as oil is important to all industry, other industries are important to oil. This offers many opportunities for companies and individuals alike to participate with ideas, processes and new developments.

"For instance, the Manufacturing, Service and Supply companies have given us technological advancements, better equipment and modernized tools to drill for and produce oil.

"In truth, these companies have been as responsible for the success of our industry as the producers themselves.

"The Manufacturing, Service and Supply companies typify the freedom of the oil industry . . . our progress is evident."



MR. W. K. WHITEFORD

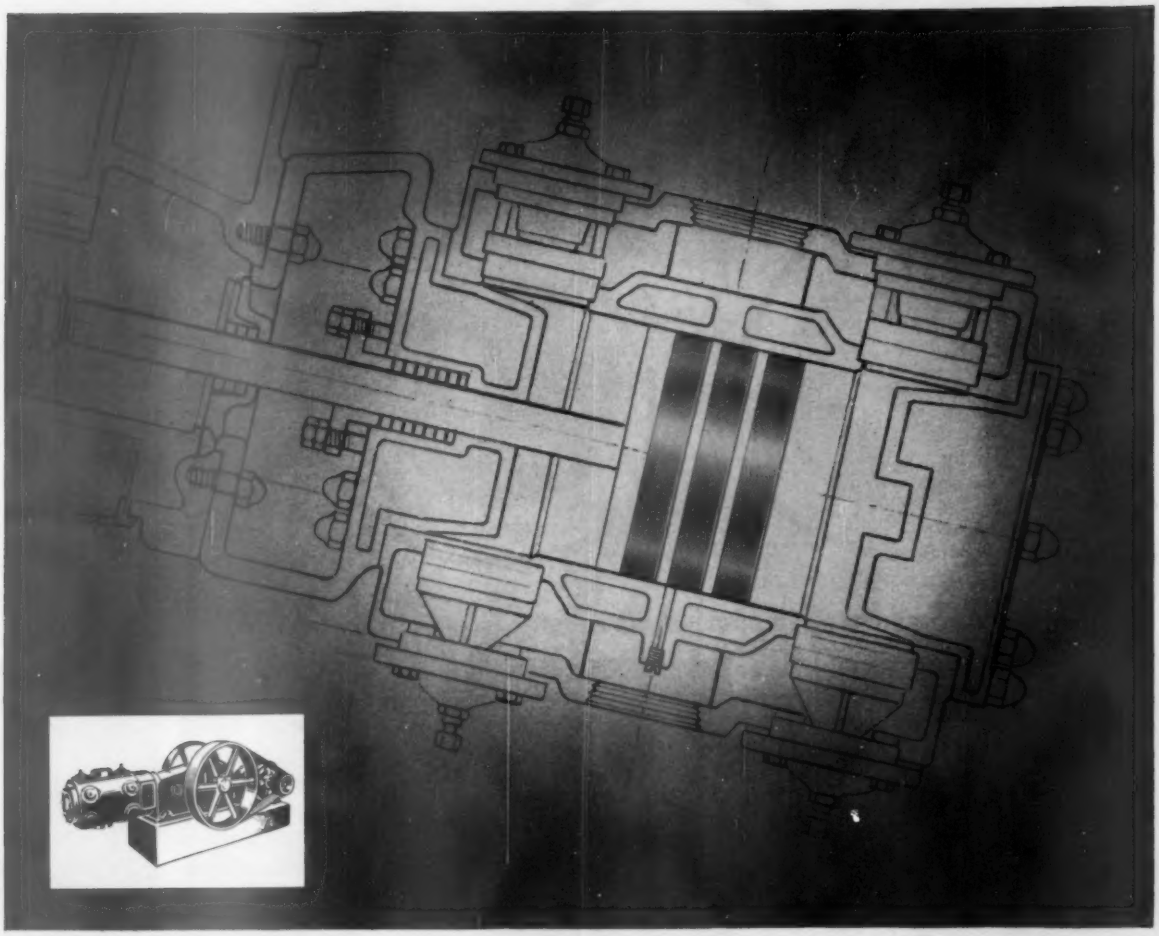
President and Chief
Executive Officer
Gulf Oil Corporation

P.E.S.A.*

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION



Piston rings made with TFE resins cut replacement and maintenance costs

In a heavy-duty compressor, a set of piston rings and wear rings (shown above) made of a filled TEFLON TFE resin has made possible substantial savings in replacement and maintenance. The rings that were replaced by rings of TEFLON TFE resin cost two and one-half times as much, and lasted less than a week on the average. The rings made with the TEFLON TFE resin were still in operation after three and one-half years of service. According to the manufacturer, maintenance savings amount to approximately $3,750 labor/year/machine.

The unique combination of properties offered by TFE resins makes possible improved performance, greater reliability and lower costs in all types of floating-ring applications. TFE resins have the lowest static coefficient of friction of any solid material —less than 0.04. They eliminate problems of slip-stick, and permit the use of non-lubricated rings. In addition, their exceptional resistance to temperature extremes and their complete inertness to almost all chemicals and solvents make them ideal sealing materials under the adverse conditions often encountered in the petroleum industry. In everyday seal applications as well, floating rings of TFE resins provide longer life, safer and more reliable operation and reduced maintenance costs.

Find out more about TFE-fluorocarbon resins and how they can lead to improved seals of all types. Write to: E. I. du Pont de Nemours & Co. (Inc.), Advertising Department, Room T-3021, Nemours Building, Wilmington 98, Delaware—or consult your supplier.

DU PONT
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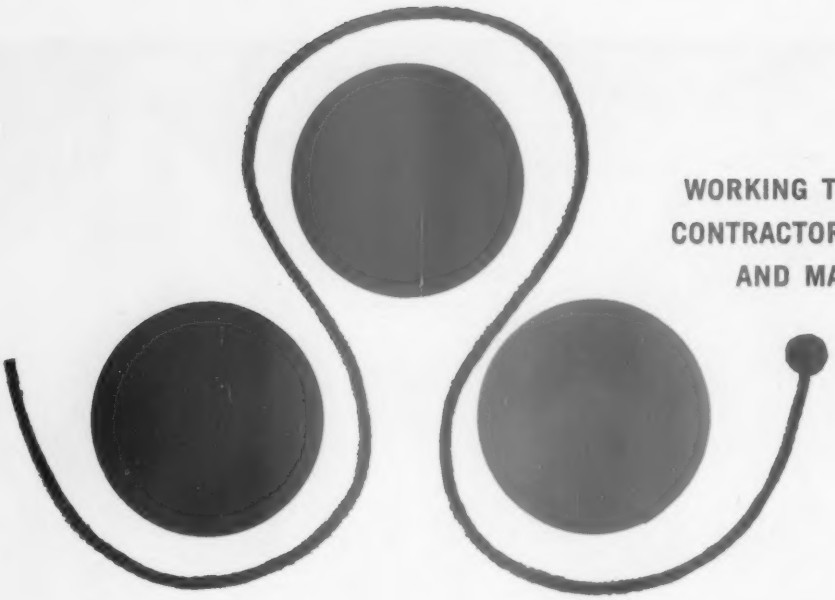
TEFLON
TFE-FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



WORKING TOGETHER... CONTRACTOR, PRODUCER, AND MAGCOBAR

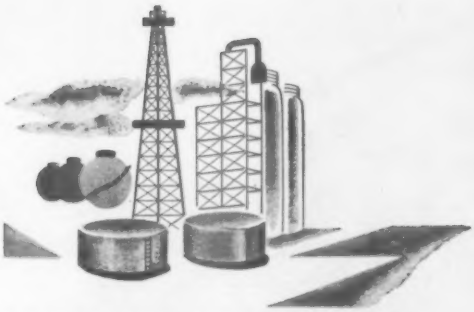
plan mud programs for pay and profit

High drilling costs can be cut by efficient use of drilling fluids. The right drilling chemicals, **used right** by Magcobar engineers, can help increase penetration rates, save on trips and bits, reduce materials needed, and save on equipment and manpower.

But, to make sure that the mud program is the most efficient, it must be planned from the beginning. And, because it must deal with so many specifics, it can be developed only with the close cooperation of producer, contractor, and Magcobar engineer. A sound mud program must be based on product performance, formations to be drilled, and very important, type of equipment to be used.

By working together, a planned mud program can be developed to make full use of the money-saving advantages of Magcobar Technology. This Technology formulates special drilling fluids to reduce or prevent damage to the pay, resulting in quicker completion, higher production, and less need for expensive stimulation work. Magcobar Technology can help you as a contractor to drill wells more cheaply, can help you as a producer to have better wells. Drill your next wells with Planned Mud Programs with Magcobar.

Magcobar
Complete
DRILLING MUD SERVICE



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STOP WEEDS

with safe, effective

SIMAZINE or ATRAZINE

pre-emergence *pre- or post-emergence*

HERBICIDES

Economical, long residual Geigy herbicides save time and money—do the job right the first time. One application stops weeds before they start—gives you season long control.

Safe to humans and animals, non-irritating to skin, non-flammable, non-corrosive to equipment. Safe to use on valuable land. Available through leading distributors.

FREE BROCHURE:
New full color booklet contains complete directions, diagrams, applications and other useful data for both Simazine and Atrazine.

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Geigy *ORIGINATORS OF DDT INSECTICIDES*

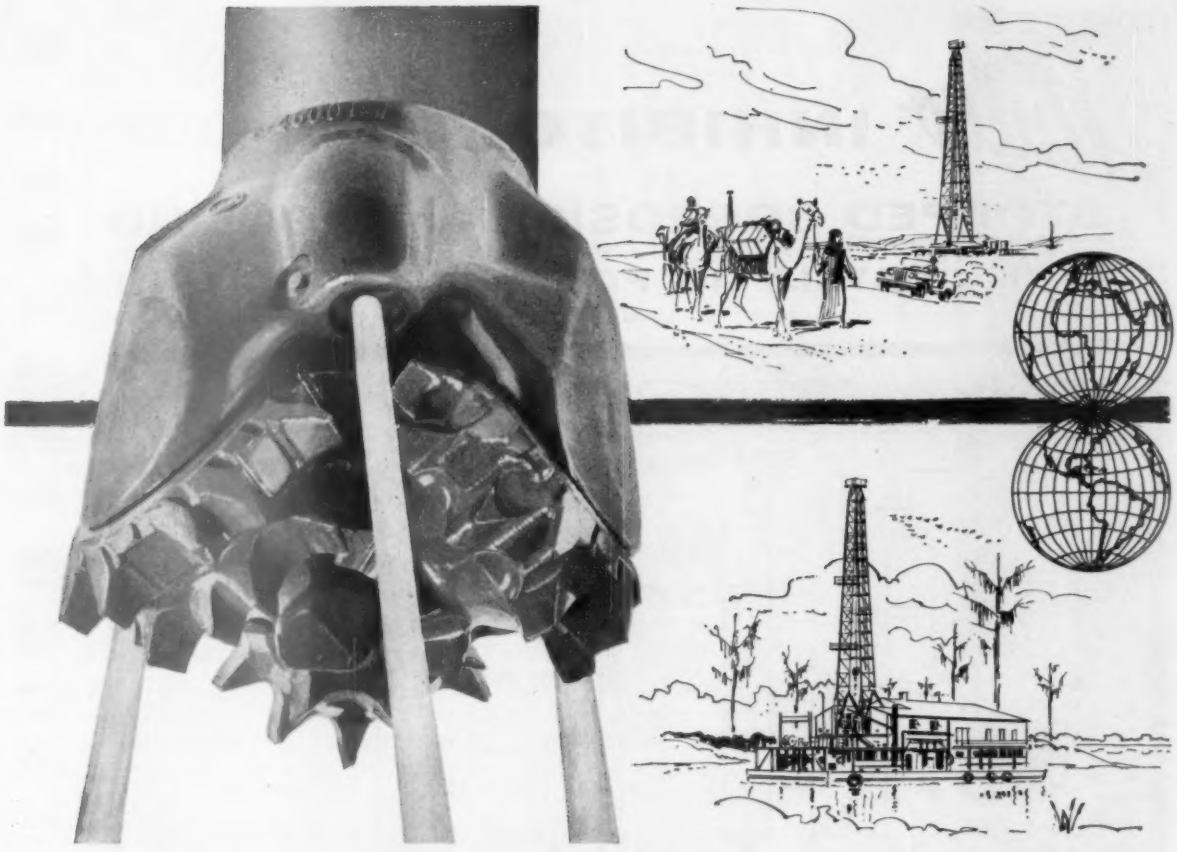
THERE are two big reasons why the trade-mark "Timken" guarantees top bearing value. 1.) It assures you of uniform high quality and performance. From the steel right through to final inspection, Timken® bearings are made to the industry's most exacting specifications. 2.) You're assured of the finest bearing service available.

"Timken" is the registered trade-mark that identifies tapered roller bearings, fine alloy steels and removable rock bits made by The Timken Roller Bearing Company. For your guarantee of value, specify "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

BETTER-NESS rolls on

TIMKEN®

tapered roller bearings



RIGHT Around the World!...

for DRILLING ECONOMY

Security rock bits — in 1120 types, sizes and variations — are furnished for every drilling condition encountered in this world of oil. All Security bits are offered in regular, jet, air, and jet-air circulations.

Security's S3J jet bit, pictured above, cuts drilling costs equally well in Libya and in the Texas-Louisiana Gulf Coast. Other Security jets set similarly outstanding penetration records in Venezuela and the Rocky Mountains.

All are constructed to the same superior design specifications, metallurgical values, and quality control standards. That's why Security is right around the world! . . . the *right bit for the job* wherever in the world you drill.

Drill with Security all the way! Write for Security's catalog today.

Security

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CANADA . . . Security Engineering Canada, Ltd., Edmonton, Alberta, Canada
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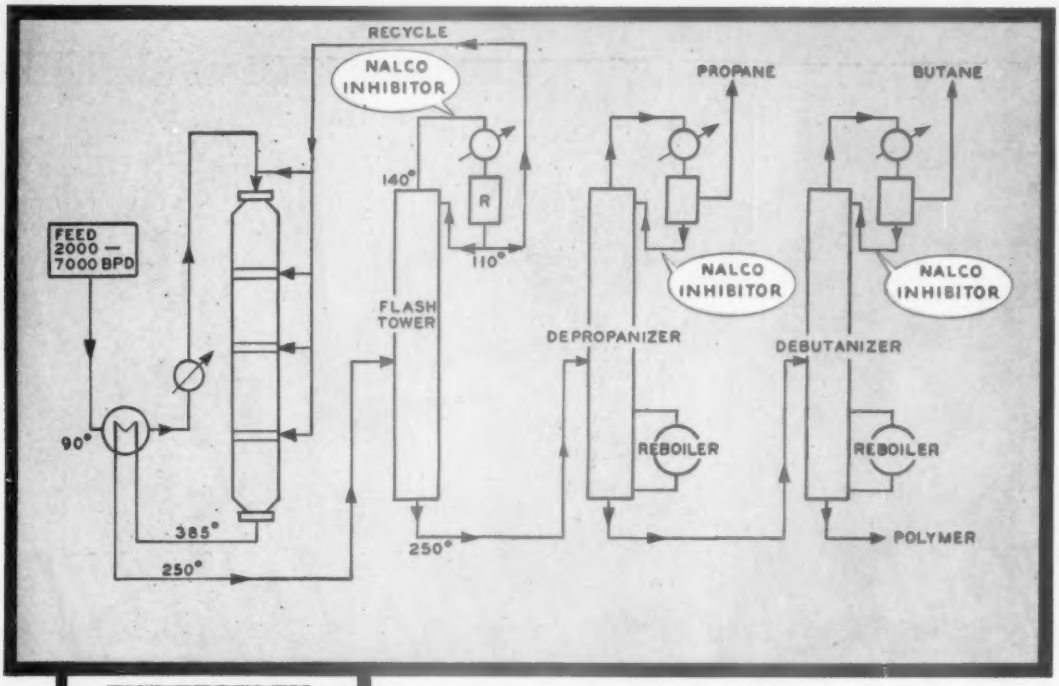
Nalco INHIBITORS

STOPPED CORROSION and FOULING in this CATALYTIC POLYMERIZATION UNIT



THE PROBLEM

1. *Corrosion* of the steel tube bundles of the flash tower overhead condenser with accumulator water pH of 4.5 or below.
2. *Serious fouling* of screen trays in the depropanizer and debutanizer on normal six-month run.

THE TREATMENT

Nalco Inhibitor fed to the overhead of the flash tower, and to the reflux of the depropanizer and debutanizer towers.

THE RESULTS

1. Iron content of accumulator water reduced from .75 pounds per day to .04 pounds per day.
2. No deposits in screen trays after six-month run.

CONSIDER further the economy of dosage . . . 10 ppm to flash tower, and 10 ppm to depropanizer and debutanizer. And bear in mind that this was no isolated success story. The same advantages—less downtime, better thruput *and* effective protection for costly equipment—can be brought to your refinery by the use of Nalco Corrosion and Fouling Inhibitors. Ask your Nalco Representative or write direct.

National Aluminate Corporation is now

NALCO CHEMICAL COMPANY

6242 West 66th Place • Chicago 38, Illinois

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THE Nalco® SYSTEM . . . *Serving Industry through Practical Applied Science*

Nalco CHEMICALS

COMPLETED AS A PRODUCER . . .
BELOW 20,000 FEET

Had this well been dry, it would merely be another statistic. Yet, it was completed as a producer.

To prove production possibilities on this deep Louisiana well, five Drill Stem Tests were run below the 20,000 ft. mark. In each instance, the packers were set below 20,000 feet, making these the deepest Drill Stem Tests ever recorded.

Testing conditions were most severe. Throughout each test, bottom hole temperature was 426°, mud weight ranged from 18.2 to 18.4, with a viscosity varying from 50 to 60. During the five deep tests, Johnston equipment encountered and recorded formation pressures as high as 19,365 psi and hydrostatic mud pressures up to 22,045 psi.

Packers and other equipment have previously been run and set below this depth; however, none in a Drill Stem Testing operation, nor under the conditions encountered in this well.

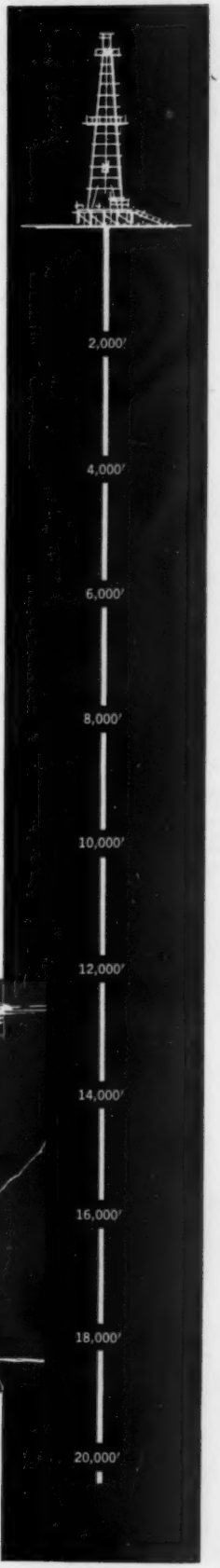
No misruns or equipment failures occurred. All equipment was retrieved intact. On two tests, equipment remained in the hole over twenty hours. Tests were performed in 7 inch—35 lb. casing through a 3/8 inch bottom hole choke. All were successful.

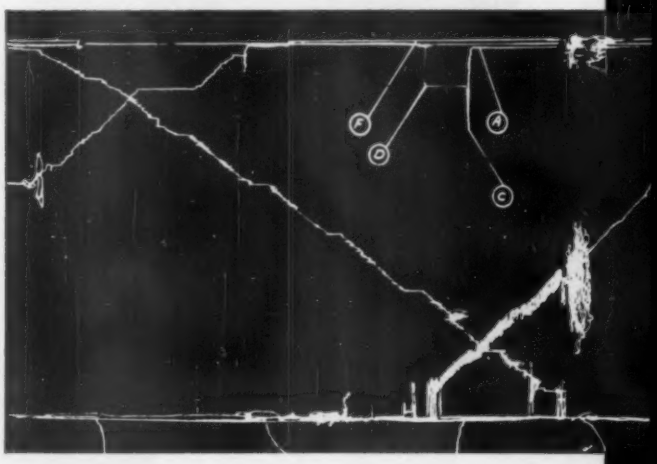
Drilling a well below 20,000 feet is a significant accomplishment, especially with the subsurface conditions peculiar to the Gulf Coast. The five Johnston Tests performed at this depth are also significant. They are testimony to the fact that Johnston can conduct Drill Stem Testing operations at extreme depths where high bottom-hole temperatures and extreme high pressures are encountered.

The drilling, testing and completion of this well is a prime example of the value of experience and planning, and proves the advisability of gathering all available information and data for evaluation prior to completing any well.

In any area . . . in any well . . . deep or shallow . . . high pressure or low pressure . . . before you set casing on your next well, call Johnston Testers. You get more from a Johnston test.

All tests were performed by Johnston Testers using the new Johnston testing tools.





FINAL TEST
Packer set at 20,068′
Initial Hyd. Mud 19,960 psi
Initial Flow 15,435 psi
Final Flow 17,719 psi
Final Hyd. Mud 20,061 psi
Recovery Oil (39.5° Gravity) and Gas

JOHNSTON TESTERS, INC.

P. O. Box 98 Houston 1, Texas

INTRODUCING SHORT NEW
CHEVROLET
TILT CAB TRUCKS

72" BUMPER TO BACK OF CAB

They're built like "tilts" should be built—that's the story on this new line of trucks from Chevrolet. All of the special advantages of tilt cab design—compactness, extra payload capacity, easy maintenance, maneuverability—are better than ever before. And Chevy brings you some extra-special benefits, too!

MOST COMPACT IN ITS CLASS for higher profit payloads. Six-foot-bumper-to-back-of-cab dimension gives you more cargo space than ever before (almost 60 cubic feet more than other tilt cab trucks!). You can carry bulkier payloads in a bigger body; and you can carry *heavier* payloads, too, because the extra space means more of the load weight can be carried by the front suspension. This *shorter* design means longer profits!

BEST MANEUVERABILITY. With comparable body sizes, new Chevrolet tilt cabs are as much as 2½ feet shorter overall than conventional models and save up to 48 inches in wheelbase. This *minimized* length and wheelbase pay off in *maneuverability*—easy handling in tight places that will save you time and work every day.

ROOMIEST CAB in its class! New Chevy tilt cabs are big and comfortable inside. A full 6½ feet wide, with plenty of head room and leg room for rangy drivers. And there's the safety of "picture window" visibility through a sweeping glass area.

REVOLUTIONARY TORSION-SPRING RIDE standard in all models! Independently suspended front wheels step nimbly over bumps . . . and friction-free torsion bars soak up jolts of all sizes. New variable-rate rear springs complement the new front suspension perfectly. The result is an amazingly smooth ride that assures higher safe cruising speeds, more work done every day . . . plus longer truck life with lower maintenance costs.

And in every new Chevy tilt cab model, new tougher built rear axles and brawny new box-section side-rail frames team up with the best kind of big truck power.

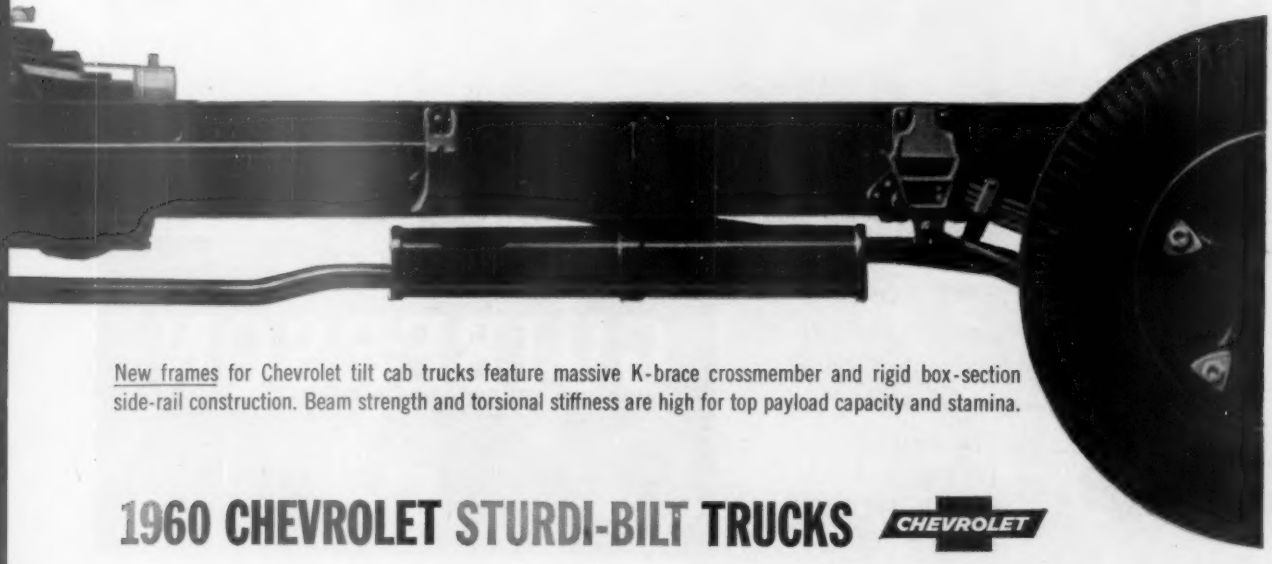
New ease of maintenance slashes upkeep costs. Maintenance can be performed in as little as half the time required for conventional trucks!

Stationary control island is solidly mounted on truck frame. Short linkage is dependable and easy to adjust.

Torsion-spring tilting hinge takes the work out of tilting. A tough torsion bar counterbalances the cab's weight and makes cab tilting a breeze.

Triple-safe locking system provides protection against accidental tilting. Keeps cab securely anchored down when you're under way.

20 NEW MODELS IN 5 SERIES. Five rugged medium- and heavy-duty series offer G.V.W.'s up to 25,000 lbs. Money-saving power is provided by Chevy's famous truck-built engines—economy-minded 6's for all models up to 22,000 lbs. G.V.W. and tough V8's for bigger models. Chevy makes tilt cab design *work* like never before; you can see for yourself by visiting your Chevrolet dealer right now! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.



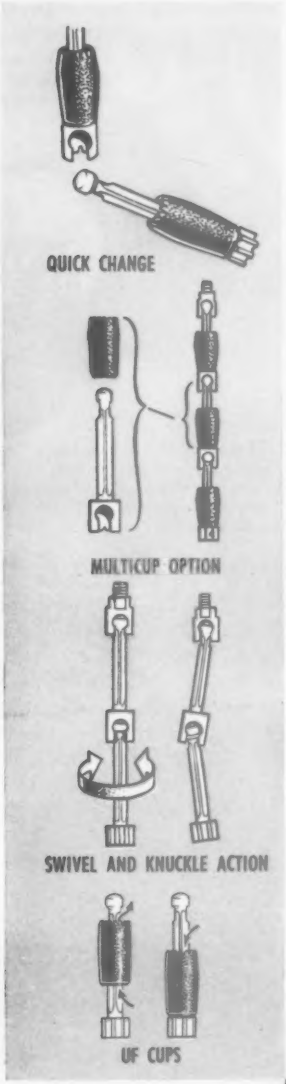
New frames for Chevrolet tilt cab trucks feature massive K-brace crossmember and rigid box-section side-rail construction. Beam strength and torsional stiffness are high for top payload capacity and stamina.

1960 CHEVROLET STURDI-BILT TRUCKS CHEVROLET

CUT COSTS.. SPEED-UP SWABBING with NEW

GUIBERSON Knuckle Joint Tubing Swab

and SENSATIONAL MULTI-PURPOSE UF CUPS



QUICK CHANGE — New ball-and-socket design, another Guiberson first, lets you change cups in *ten seconds* with the swab hanging on the line . . you don't even have to lay the swab and sinker bars down. No pipe wrenches or other tools are required. This one feature reduces cost tremendously . . but that's not all . .

MULTICUP OPTION — Add a cup and upper mandrel . . as many as desired. No need to carry several different swabs . . no time lost in changing swabs. There are only five parts in a two cup swab . . sub, cups, upper and lower mandrels. Heat-treated steel parts are individually tested to withstand heaviest swabbing loads.

SWIVEL AND KNUCKLE ACTION—You get full 360° swivel at the bottom socket joint and 5° knuckle action at every joint. With any number of cups and even in crooked tubing, the combination of knuckle action and ample bypass makes this the fastest-falling swab ever run.

UF CUPS — Are strong, flexible, long life . . made from special compound with a valve ring molded in the base. Thus, new valves are obtained each time the swab is redressed. Cups travel freely on the mandrel, allowing bypass inside and outside the cup in the up position . . sealing perfectly in down position. The UF cups, designed especially for the knuckle joint swab, are strongly reinforced for heavy loads . . flexible enough for light loads . . small enough for tight tubing. Use the knuckle joint swab with UF cups and lift more fluid in fewer trips.

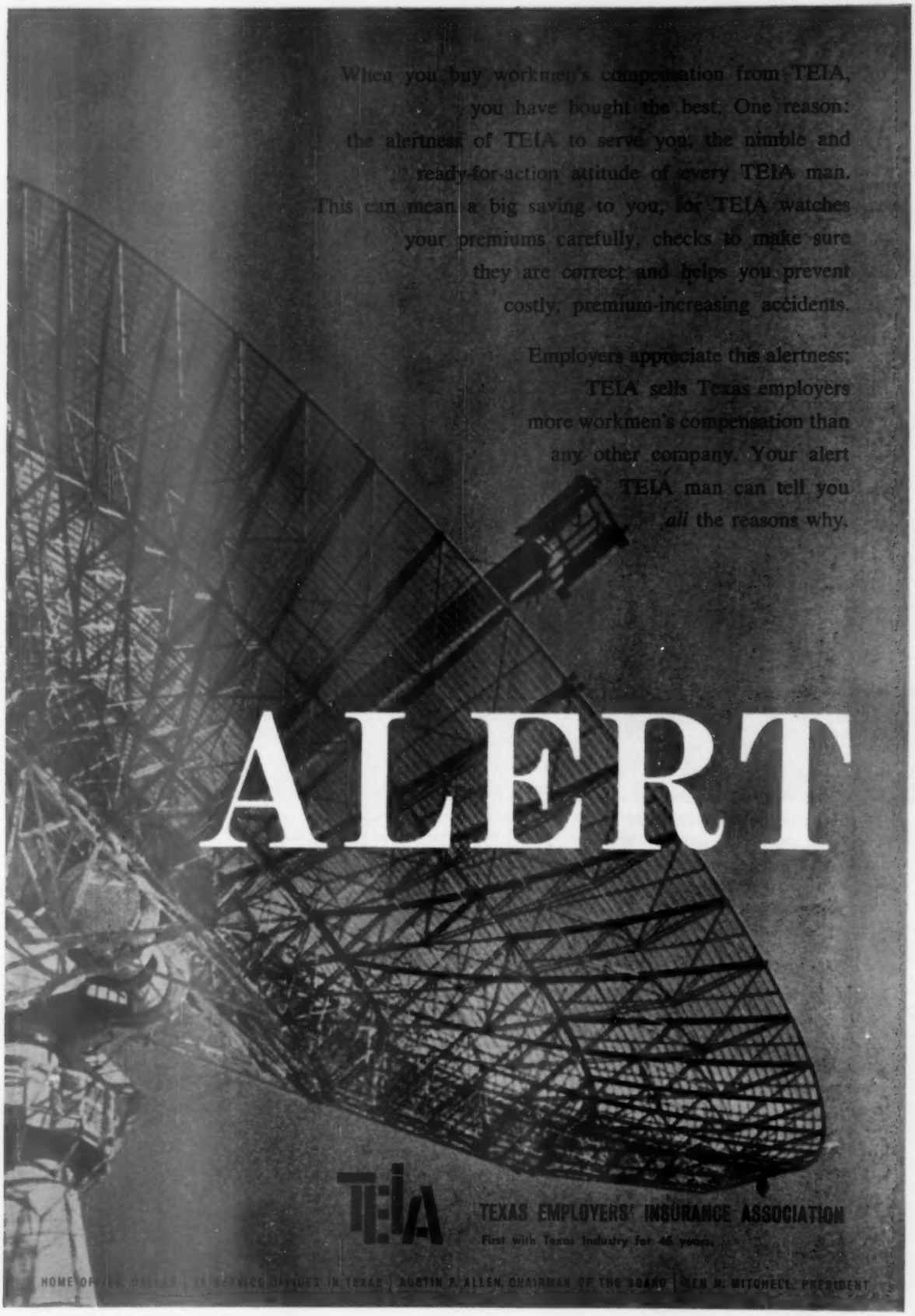
SAVE MONEY ON YOUR NEXT JOB WITH THIS SWAB

Sold by OIL FIELD SUPPLY STORES EVERYWHERE

SAVE TIME SOLVE BETTER OR MORE VIBERSON

THE GUIBERSON CORPORATION

ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.


When you buy workmen's compensation from TEIA,
you have bought the best. One reason:
the alertness of TEIA to serve you, the nimble and
ready-for-action attitude of every TEIA man.
This can mean a big saving to you, for TEIA watches
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they are correct and helps you prevent
costly, premium-increasing accidents.
Employers appreciate this alertness;
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more workmen's compensation than
any other company. Your alert
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ALERT
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First with Texas Industry for 46 years.
HOME OFFICE, DALLAS | 74 SERVICE OFFICES IN TEXAS | AUSTIN F. ALLEN, CHAIRMAN OF THE BOARD | BEN H. MITCHELL, PRESIDENT

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Ethylene Glycol Scores High As Hydrate Inhibitor

In refrigeration-type gasoline recovery plants, the most widely used hydrate point depressant is diethylene glycol. But, ethylene glycol may offer certain advantages as a replacement in your plant, for example . . .

SELECTION GUIDE

ADVANTAGE	Ethylene Glycol	Diethylene Glycol
Hydrate Inhibition	GOOD	GOOD
Ease of Separation	BETTER	GOOD
Cost	LOWER	—
Vaporization Loss	LOW	LOWER
Solubility Loss	LOWER	LOW

HYDRATE INHIBITION

While both ethylene and diethylene glycol give good hydrate inhibition, with hydrate point depressions generally in the range of 60° to 80°F., reports indicate that ethylene glycol may give a greater depression in those cases needing very low separation temperatures.

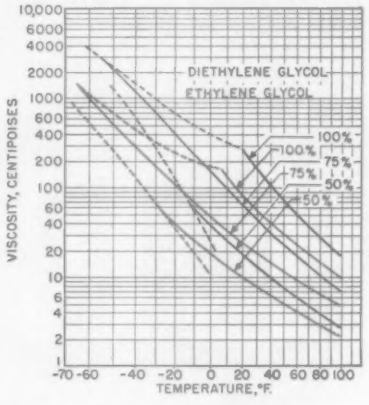
EASE OF SEPARATION

Ethylene glycol-water solutions are easier to separate at very low temperatures than diethylene glycol-water solutions.

This advantage is illustrated in the graph below. At 0°F. the viscosity of a 50 per cent ethylene glycol solution is 20 centipoises, or half the viscosity of the diethylene glycol solution.

An even more marked difference is shown at lower temperatures . . . at—40°C. a 75 per cent ethylene glycol solution has a 300 centipoises viscosity, as compared with 1000 to 2000 for a 75 per cent diethylene glycol solution.

VISCOSITY OF GLYCOL-WATER MIXTURES



COST

Ethylene glycol costs 1¾¢ a pound less than diethylene glycol which means a possible tank car savings of $1,300.

VAPORIZATION

Although ethylene glycol vaporization losses are greater than diethylene glycol's, the difference is insignificant below 30°F., if separator pressure is 750 PSI or higher.

SOLUBILITY

At separation temperatures of 60°F., glycol losses due to solubility should be in the range of 10 to 50 ppm when 50 to 75 per cent ethylene glycol solutions are used; and 20 to 100 ppm with equal strength diethylene glycol.

The higher volatility of ethylene glycol must be taken into consideration in regeneration equipment design and operation; but ethylene glycol may offer advantages in certain systems. Your CARBIDE Technical Representative can show you data on the pros and cons of ethylene or diethylene glycol hydrate inhibition in your system.

For a copy of a new report, "The Glycols as Hydrate Point Depressants in Natural Gas Systems" and a comprehensive bibliography of all the major articles published on gas sweetening and dehydration in the last 25 years, use the coupon.

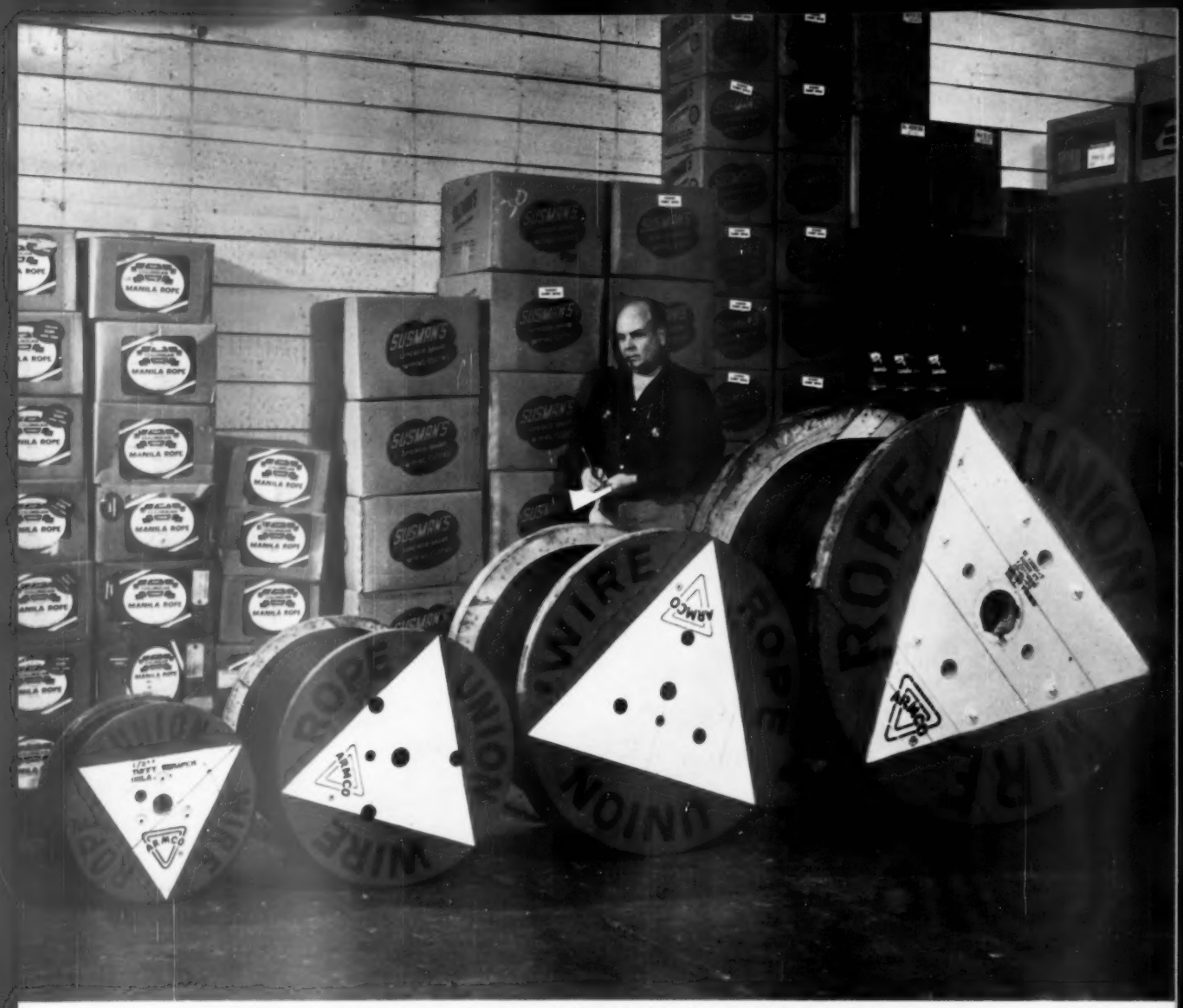
UNION CARBIDE *is a registered trade mark of Union Carbide Corporation.*

UNION CARBIDE CHEMICALS COMPANY, Rm. 328, Dept. G, 30 E. 42nd St. New York 17, N.Y.
Please Send Me

- ☐ Technical data report—"The Glycols as Hydrate Point Depressants in Natural Gas Systems."
- ☐ 15-page Gas Sweetening Bibliography.
- ☐ Please have a CARBIDE Technical Representative call.

NAME: ..... POSITION: .....
COMPANY: .....
ADDRESS: .....
CITY: ..... STATE: .....

UNION CARBIDE CHEMICALS COMPANY
DIVISION OF
UNION CARBIDE CORPORATION



It's easy to order Tuffy Wire Rope from National Supply. No complicated specifications — just give the application and specify length and diameter.

Tuffy® joins the National Supply family of quality products

Right now, *Tuffy* Rotary Lines and other "job prescribed" Union Wire Rope products are available through National Supply Stores in the United States. We're pleased to have *Tuffy* wire rope in the family for two main reasons. First, it's the product of Union Wire Rope, *specialists* in high carbon wire rope, braided wire fabric and stress relieved wire and strand. Second, *Tuffy* is a quality product, proved not only on the world's deepest well and throughout the oil industry, but also in construction and many other industries.

Let National solve your wire rope problems with *Tuffy* Rotary Lines, Sand Lines, Cut Rope and Slings. Like all the fine products available from National, *Tuffy* will give you longest service, greatest efficiency and safety.

More on the next page . . .

A National 80-B is checked during rig-up in our Houston Plant yard. Notice its compact arrangement. Suitable for medium depth drilling, the 80-B is rated at 1,000 horsepower.

The 80-B drawworks proves the speed and service life built into all National Rigs!

A rig you can count on—for drilling speed and efficiency, as well as long service life—is worth every dollar you invest in it. National Supply builds this type of rig, and you need only examine any one closely to prove its value. Take some of the features of National's 80-B, for example:

Unitized drawworks—Except for a detachable front base section for reducing width to the 8-ft. transportation limit, the 80-B drawworks remains intact and completely assembled. (Remember, this is a 1,000 horsepower rig for 8,000 to 12,000-ft. drilling!) Controls, catheads and auxiliary brake are undisturbed. The 80-B transmission is three-speed, with two drives forward to the drum shaft.

Centralized controls—Control design and arrangement are dictated by the convenience and safety needs for maximum speed of operation and drilling ease.

High strength drum shaft—Improved design drum shaft results in increased strength to shaft, better water circulation and better support and fit for spooling drum.

Large hoisting drum—25″ wide and 49″ long, it is exceptionally large for a rig of this size. You can handle 90-ft. stands of drill pipe without spooling more than three full layers of line.

Most efficient drum brake—The 80-B has a National Type K-46 Compound Equalizing Drum Brake—proved to be the best in the industry.

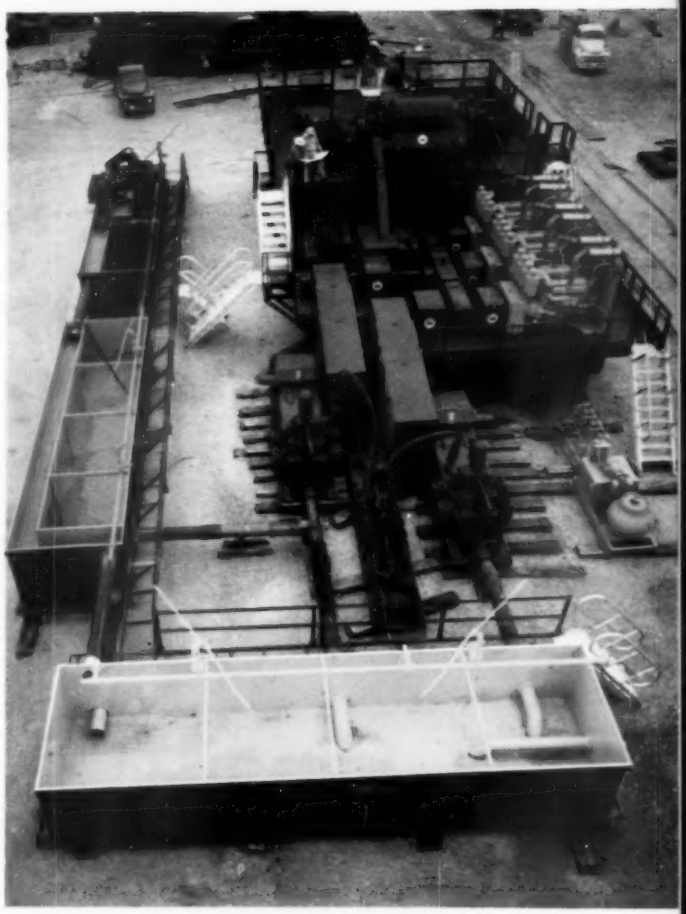
Air-cooled, operated clutches—Dy-A-Flex Clutches are mounted outside bearing supports for easy accessibility. Shoes are self-contained and do not require disassembly for lining replacement.

Heavy-duty catheads—National air actuated catheads are self contained, permit the driller to pull tonging or spinning lines with precise control.

Large core reel—Has a capacity of 12,500 feet of 9/16″ line. Nested arrangement of reel brake rim and clutch element permits a very compact design.

Other important features—Maximum convenience in all handling, control and routine operations including maintenance is further assured by: Unitized rope rollers, catline guides and sheaves; fully enclosed cascade lubrication for all chains, sprockets, mechanical clutches; all lubrication points plainly marked and easily accessible; air, oil and water pressure gauges in control cabinets; hand and foot throttles.

Take advantage of the compact rig design leadership you can see in National's 80-B drawworks—or any other National drawworks. Talk over your rig needs now with the National representative in your area.



Over-all view of the 80-B rig-up shows the three-section National Drive Group and two K-700 pumps.

More on the next page . . .

...and check these advantages of National Drive Groups!

Sectional Construction—A basic advantage pioneered by National, this insures unmatched and fast adaptability to various drilling and slush pump requirements. Drives are compact, factory pre-aligned, easy to move and rig-up.

Engine Compound Chain Enclosures—When the group sections are joined, chain is enclosed in a continuous, in-line case. Chain is cascade lubricated from a built-in oiling system. Chain enclosures can be quickly broken for moving or inspection, and have protective cover plates for moving and storage.

Power Transmission Arrangements—Engines may be furnished with National Hydraulic Couplings, National Torque Converters and air clutches.

Engine Adaptability—Pads or bases for mounting selected engines are integral in the frames. Any make of engine in oil field use may be installed.

Optional Pump Drives—These include: Drives for one, two, or three slush pumps; V-Belt or chain drives to the pumps; Single or two-speed pump drives.

National Dy-A-Flex Air Clutches—Outstanding for rugged performance, these clutches are furnished for pump drives and, on rig drive groups, in the master clutch position.

Air Operated Controls—Air piping for controls is installed in the frames at the factory, permitting control of all rig functions from the driller's panel. These include controls for: engine throttles and clutches, pump drive clutches, master clutch and inertia brake, and (when specified) fluid drive scoops. Upon request, extra control locations can be tailored for any requirement.

Complementary Equipment—Integrally mounted air compressor equipment for the rig control system is standard. Other drives for generators, dual air systems, etc. can be furnished to your specifications.

Complete Factory Testing—All National Drive Groups are assembled, lubricated and test run prior to shipment. Surfaces are protected by rust preventatives and all exposed surfaces are painted.

The National Representative in your area will be glad to give you more information on National Drive Groups, Drawworks, and related auxiliary equipment. Ask him soon.

This drive group section of the 80-B rig shown on previous pages includes a National Auxiliary Drawworks Drive. Mounted on a countershaft on the front engine frame, the Auxiliary Drive permits all engines to operate as a single power unit while drilling, affording flexible power distribution to all driven components as required.

THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation

DIVISION OFFICES: Calgary, Columbus, Dallas, Denver, Houston, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N. Y., U. S. A.; City Wall House Chiswell Street, London E. C. 1

Printed in U. S. A.

HE MAKES HIS ENGINE STALL

...so yours won't!

Charles Domke (right) is one of the few men we know who takes a positive delight in having his engine stall in sub-zero weather. He and Mechanic Verland Stout change gasoline blends frequently. When the engine stalls, they try another blend. Their objective, of course, is to find the perfect gasoline under various climatic and road conditions—and the true test is on the road itself!

Charles Domke has one of the world's most unusual jobs. He *tries* to have engine trouble!

He's a Project Automotive Engineer at Standard Oil. In all kinds of weather—hot, cold, wet, dry, low barometer, high barometer—he goes driving. First thing you know, he'll stop and change fuel, put in a different blend of gasoline to see what happens. If it stalls, he doesn't call a tow truck. He just puts in another blend of gasoline.

You might say he *makes* his engine stall...so yours won't!

What Mr. Domke and other automotive engineers learn from these constant experiments is used to give you gasoline that is blended especially for the region of the country in which you live and also for the season.

It may surprise you to learn that *12 or more seasonal changes* are made in Standard gasoline every year! It is adjusted for temperature, humidity, altitude and other factors that affect gasoline performance in your area.

A pioneer in petroleum research, Standard Oil is famous for its "firsts" in petroleum progress. Since our first research laboratory opened 70 years ago, our scientists have been responsible for many major petroleum advances—from making a barrel of oil yield more gasoline to discovering a way to get more oil out of the earth.

Charles Domke and other scientists at Standard Oil and its affiliated companies are searching continually for ways to make oil products serve you better...to make petroleum *more useful to more people than ever before!*

What makes a company a good citizen?

For a company, good citizenship is more than obeying the law and paying taxes. It is looking ahead, planning for the future, making improvements. America has grown to greatness on research conducted by private business for the benefit of all.

The gasoline that performs best in icy conditions will cause engine difficulty in hot weather. Standard gasoline formulas are changed twelve times a year to assure peak performance in every season. Mixtures also differ from one geographical location to another in order to offer customers more gasoline value for their dollar.

STANDARD OIL COMPANY
(INDIANA)

STANDARD

THE SIGN OF PROGRESS...
THROUGH RESEARCH

MEN, MACHINES, IMAGINATION and BETHLEHEM LINE PIPE

Make Commonwealth Loop a Reality

IMAGINATION AT WORK. To wrestle the pipe through the stump-studded mire would have involved too much time and effort. So Latex capped the pipe and floated it into position along the water-filled ditch.

PROBLEM: FIND THE TRACTOR. It took great skill to move in and out of the undergrowth without bogging down or snagging a tree with the boom.

Deep in Virginia's Blackwater Swamp, the Latex Construction Company pushed through a new looping line for Commonwealth Natural Gas Corporation. From Ivor to Suffolk, the men battled mud and water, heat, insects, and dense undergrowth. But they never had to battle the pipe: each length of the 12¾-in. OD Bethlehem electric resistance-weld line pipe proved to be up to specs, and true to round and bevel. Result: the loop was completed on schedule, and approved for service after a single test of 800 psi pressure.

Your next line, too, will go in smoothly if you specify Bethlehem line pipe. It's a top-quality product you can rely on. Just give us a call.

THE FASTEST ROAD—and the cleanest—was often along the pipeline, itself.

BETHLEHEM STEEL

BETHLEHEM PRODUCES LINE PIPE TO 42-IN. OD

Hydraulically expanded electric-fusion-weld API pipe from 18-in. to 42-in. OD in 40-ft lengths with walls to ¾-in. in the larger diameters is made at our Steelton, Pa., plant. Electric resistance-weld pipe from 5¾-in. to 16-in. OD in lengths to 60-ft, and Beth-Co-Weld continuous buttweld pipe up to 4½-in. OD to standard API line pipe specifications are made on our Sparrows Point, Md., pipe mills.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Professional Guidance Is Your Best Assurance of Success

With some luck, a lot of bass, and plenty of time, who needs a guide? And with twenty producing days a month, 3½ per cent money, and a quick payout, it was a lot easier to get ahead in the oil business. But, when you find that conditions aren't as you would have chosen, whether it's because only a few bass are hiding in the lake or because of drastically cut allowances, the time has come to call in the pros.

The Oil and Gas Loan Department of The National Bank of Commerce is ready to help you now. There are many ways to help, and lending money is only one function of this department. The Oil and Gas specialists in this department have already helped so many others. They've helped them back on the road to a profitable operation by helping them tighten their organization, cut costs by paring fat and not muscle.

The time may well have come when you must start living under the new conditions in the oil business. There's no better way to get started than by beginning to work with the Oil and Gas Loan Department of The National Bank of Commerce.

The oil and gas business is going to be around for a long time to come. Our experience and knowledge of all business can help you to get over the next few years, can help you to keep your organization intact and in good shape. Knowing the oil and gas business is one more reason so many leading independents are with us now. They need the best in banking, and the best in banking costs no more.

THE NATIONAL **BANK** OF
COMMERCE
OF HOUSTON

EXPANDING NOW TO MAIN, RUSK, TRAVIS AND CAPITOL.

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Have you checked that
smart, new wash-and-wear
wrap on the next page?

That I have . . .
it's Polyken, and
wears like iron!

HOW TO CHECK OUT THE TOUGHEST TAPE EVER WRAPPED AROUND PIPELINE

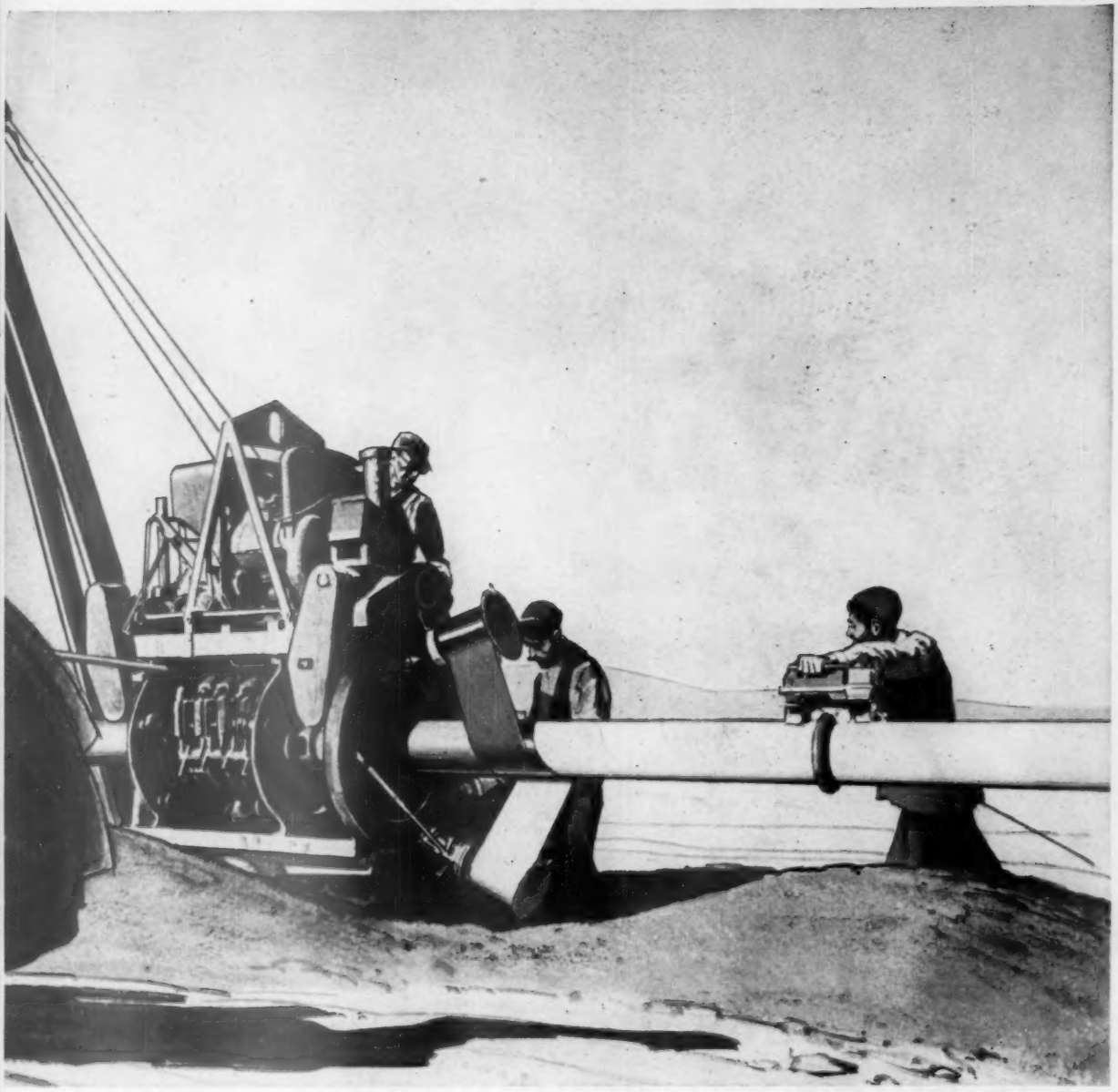
Polyken's latest development—Extra Strength Pipeline Tape No. 960—

Wrap this rugged tape around 200 miles of Iranian oil line. Ditch it in rocky desert soil. Let the burning climate do its worst. Lay it in the hard, rough ground of Canada and the swampy mire of the Florida Gulf Coast.

Run it through every coating-durability test an engineering laboratory can apply. Wrap 50,000 squares of Polyken Extra Strength No. 960 around pipe sizes from 2 through 24 inches—under a wide variety of construction conditions.

If a tape coating can take all this and still do the whole job cheaper than hot enamel, you're not merely using a better kind of tape called Polyken Extra Strength No. 960—you're realizing a major advance in the science of pipeline protection.

And look at the savings. Polyken's method pays off in the currency of less men per job, more miles per day. On the 1600-mile gas line from Louisiana to Florida, Polyken saved the Houston Texas



gets 300 miles of hard test experience in Iran, Florida, Canada and Texas

Gas and Oil Corp. *over $500 per mile,* every mile of the way.

With tensioned-spindle equipment, pipe is cleaned and wrapped in one factory-smooth operation. Tape's ready. No primer, no drying or cooling, no fumes or fire hazard—none of those hot-dope problems. And, of course, your equipment and handling costs are much lower. What's more, Polyken No. 960 is available at no extra cost.

More and more . . . big pipe is getting practical, permanent protection—Polyken protection.

Get the full particulars on Polyken performance and economy from your Polyken Representative, or write Polyken Sales Division, 309 W. Jackson Blvd., Chicago 6, Ill.

THE SMOOTH WAY

Polyken®

EXPERIENCED IN PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

This hypodermic could help cure your ailing gas conditioning system

This could be *your* sample ethanolamine solution that is being injected into a gas chromatograph for chemical analysis. This is just one of the many methods used by Jefferson's extensive research laboratories in Austin, Texas, to help you solve your gas processing problems. A wealth of technology and experience in such problems as high temperature corrosion, contamination, foaming characteristics, and excessive glycol losses is available expressly to serve your needs.

And whatever the findings, Jefferson has the *right* chemicals to meet your requirements in natural gas sweetening, refinery stream sweetening, sulfur recovery, carbon dioxide absorption, gas dehydration and hydrate prevention.

Monoethanolamine Diethanolamine
Ethylene Glycol Diethylene Glycol
Triethylene Glycol

HI-DRY® Liquid Desiccant

HI-DRY, Jefferson's special grade tetraethylene glycol, will give you the *extra* dew point depression so often needed in the dehydration of higher temperature gas streams.

You may have a knotty gas treating problem that's bothering you right now. Call the helpful Jefferson man . . . Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

Ethylene and Propylene Oxides, Glycols, Dichlorides, Carbonates • Ethanolamines
SURFONIC® Surface-Active Agents • Polyethylene and Polypropylene Glycols • Morpholine
N-Alkyl Morpholines • Piperazine • Piperazine Salts • Nonyl Phenol • Caustic Soda
HOUSTON • NEW YORK • CHICAGO • CLEVELAND • CHARLOTTE • LOS ANGELES

JEFFERSON CHEMICALS

Six choices of corrosion resistant tubes and sockets

4130 alloy steel tube with alloy steel tip and socket.

403 stainless steel tube with alloy steel tip and socket.

403 stainless steel tube with 416 stainless tip and socket.

316 stainless steel tube with alloy steel tip and socket.

316 stainless steel tube with 303 stainless tip and socket.

Monel tube with Monel tip and socket.

Tubes and sockets listed above are available in Type 100 Mastergauges which are designed for extreme service and pressures. Type 101 Mastergauges, for medium and high pressures, are available with:

4130 alloy steel tube, with alloy steel tip and socket.

403 stainless steel tube, with 416 stainless steel tip and socket.

403 stainless steel tube with alloy steel tip and socket.

STAINLESS...from socket to tip

Another Marsh development! The superlative Mastergauge is now available with stainless and alloy steel bourdon tubes. Try to find a corrosive service that isn't covered by range of materials listed above.

Tube, socket and tip—every part subjected to a corrosive medium—are fused into one piece by the "Connoweld" process . . . the exclusive process that distinguishes the Marsh Mastergauge from all other gauges.

Whether you need a gauge for corrosive service or any other critical application, Mastergauge is the one correct answer. It gives you the leak-proof Connoweld construction, the stronger, more durable copper-clad Marshalloy case, the precision Mastergauge movement, the "Recalibrator" to preserve its unmatched accuracy. Ask for data covering your specific gauge needs.

MARSH INSTRUMENT COMPANY, *Division of Colorado Oil and Gas Corporation*
Dept. L, Skokie, Ill.
Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Can.
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas.

MARSH GAUGES

"THE STANDARD OF ACCURACY"

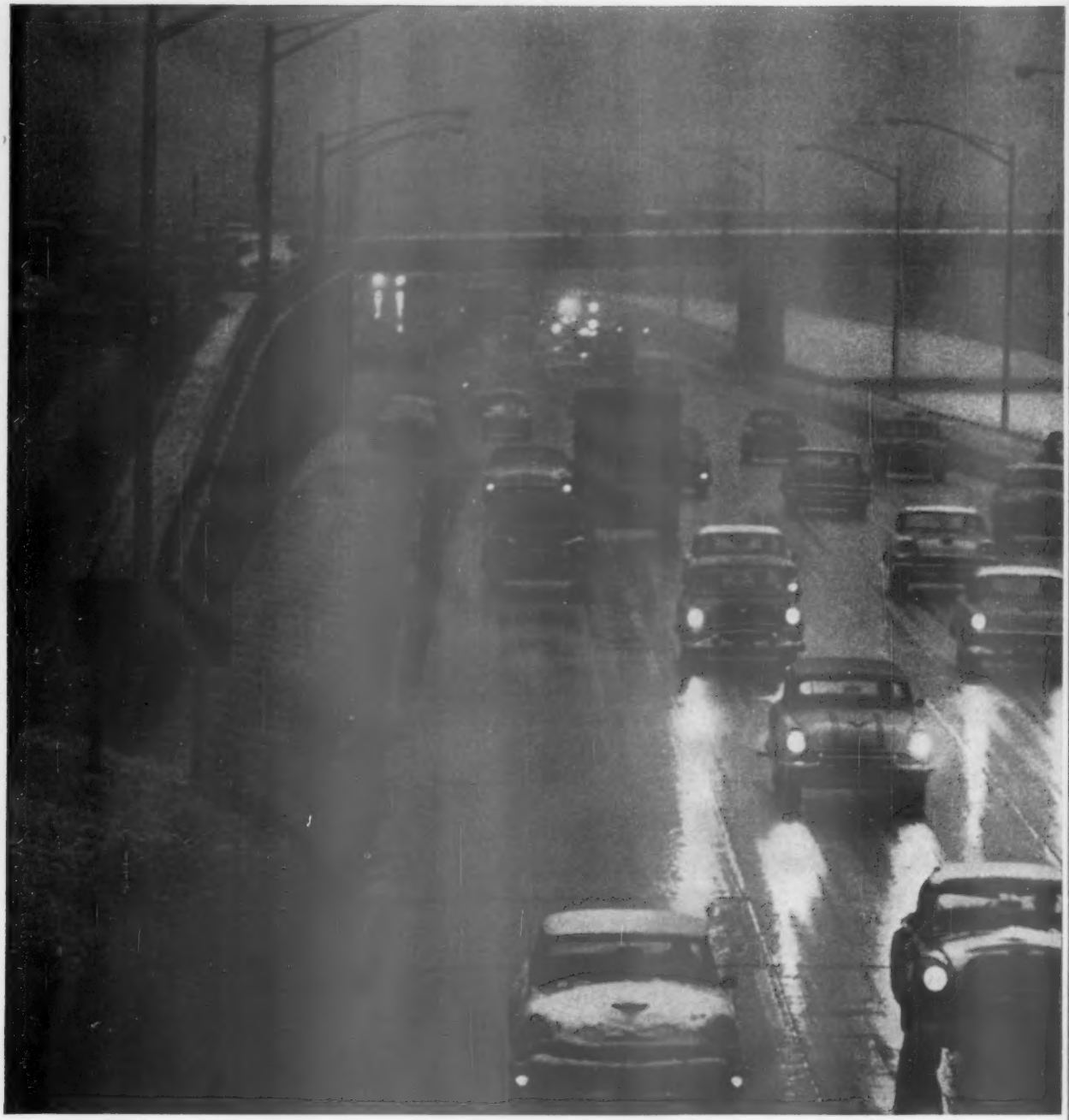
In stock at your nearest Supply House

Stainless steel tube in the new SAFECASE

Here is a great combination . . . Marsh Mastergauge with corrosion resistant bourdon tube in the revolutionary Marsh Safecase . . . everything it takes for corrosive service where a surge of overpressure can occur.

Explosive force merely opens safety back—

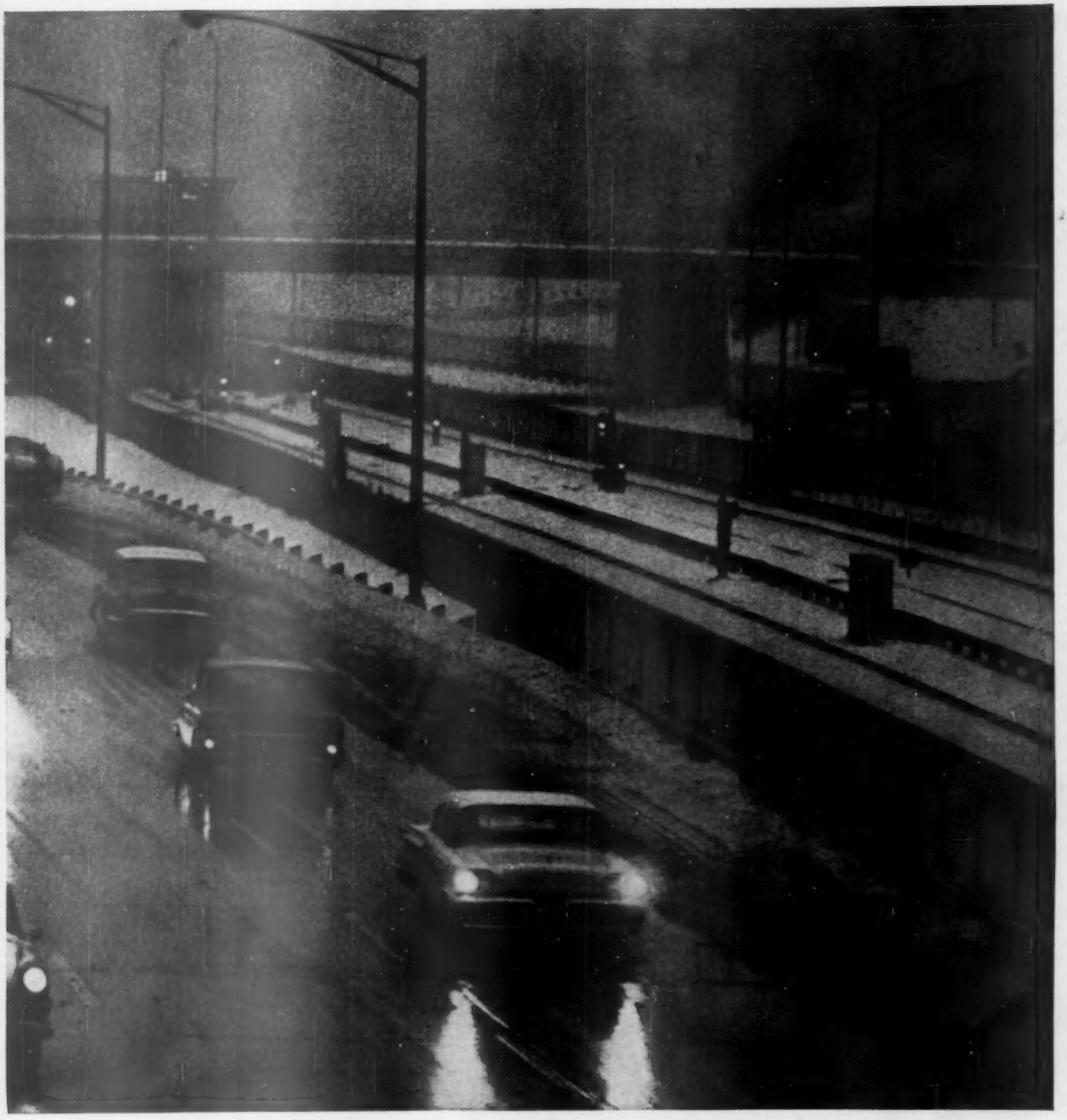
Photo shows result of laboratory test in which gun cartridge was discharged in rear compartment of Safecase. Thin, tough back yields to abnormal pressure, but cannot be dislodged by blowout. Front of gauge remains intact, protected by heavy metal barrier.



ARMOUR ANTI-STALLING ADDITIVES

Armour's **Duomeen®** compounds have been used successfully by major oil refiners the past several years to prevent carburetor icing. These anti-stalling additives are so effective that they are used on a ppm basis . . . amounts so small your costs are reduced to a fraction of what you pay for protection gained by the use of freezing-point depressants.

In addition to their anti-stalling properties, Armour's additives also help prevent corrosion and keep air-borne contaminants from forming on carburetor walls and parts. To reconfirm their savings and effectiveness in operation, an independent laboratory runs continuing tests on these Armour additives. Test results consistently establish the superior prop-



KEEP 'EM ROLLING AT LESS COST

erties and economies of these Armour additives over freezing-point depressants.

Armour also makes a wide variety of chemicals as specialized additives for automotive uses. These polar nitrogen compounds have a broad range of use. In addition to preventing corrosion in greases, lube oils and gasolines, these compounds also improve lubricity in lubricating oils, transmission fluids and greases.

To learn more about Armour's gasoline anti-stalling additives and other refined product additives, and to receive samples of them, write to:

ARMOUR INDUSTRIAL CHEMICAL COMPANY
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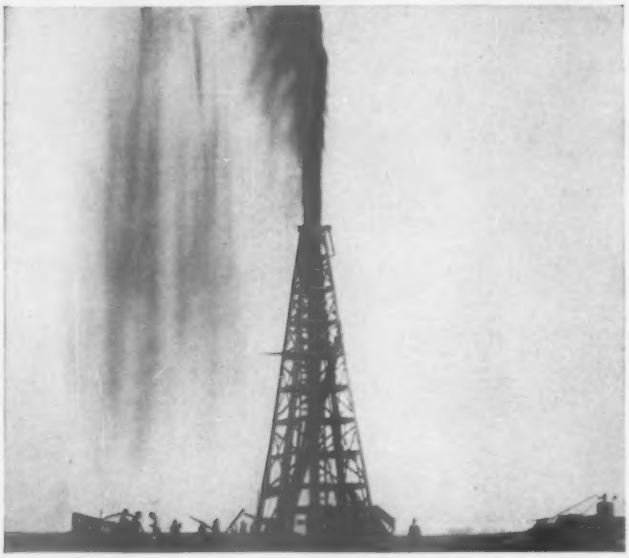
110 North Wacker Drive, Chicago 6, Illinois

NEWS ON TEXACO PROGRESS

The gusher that brought in 50,000,000 cars



YESTERDAY. When, in 1901, a great gusher blew in at Spindletop — spouting its black geyser against the South Texas sky — the whole world learned for the first time that it could have petroleum in abundance. And it was at the Spindletop field that Texaco came into being — to obtain and market Spindletop oil.

TODAY. America's millions of motor cars have only been made possible by the petroleum industry's high production of oil. Today, Texaco is the largest producer of domestic crude oil. Its integrated operations are worldwide in scope. And its laboratories are investigating not only petroleum's valuable energy, but also atomic energy. By keeping in step with the future . . . Texaco continues to grow.

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The OIL AND GAS JOURNAL

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They Say—

Registration of geologists

Dear Sir:

Thank you for your recent article concerning registration of geologists (OGJ, Jan. 4, p. 52). Many of the potential evils of registration can be avoided by adequate discussion and consideration of the nature and content of the proposed registration bills prior to their submission to the legislative bodies. Your article will most certainly encourage this discussion.

The Illinois Geological Society, through its committee on registration and licensing, has been actively studying this matter for the past year. It has, in fact, made concrete progress towards legal recognition of the status of the geologist in the form of a favorable opinion secured from our secretary of state regarding the position of the geologist under the Illinois Securities Law.

In my opinion, the present interest in registration of geologists stems from a new awareness that in our increasingly complex society, the professional status of geologists must be legislatively recognized.

One reason is to protect the profession as a whole from unfavorable legislation. Frequently, as in the case of the Illinois Securities Law, geologists are totally overlooked.

Another, and more important, reason is to protect the public from the phonies who use the title "geologist" to lend respectability to ill-advised or fraudulent schemes.

Neilson Rudd, Chairman
Committee on Registration
and Licensing
Illinois Geological Society

Licensing isn't solution

Dear Sir:

Your article, "How Geologists Feel About Registration," (OGJ, Jan. 4, p. 52) was very thought provoking.

It seems doubtful that rigid examining boards, licensing, etc., are a sound solution for the problem. Perhaps there are just as many incompetent or unscrupulous representatives of carefully restricted professions as in the geological profession.

In my opinion, most of the ills of the petroleum geologist can be attributed to, as well as cured by, the petroleum industry itself.

Managements of large companies are frequently guilty of practices

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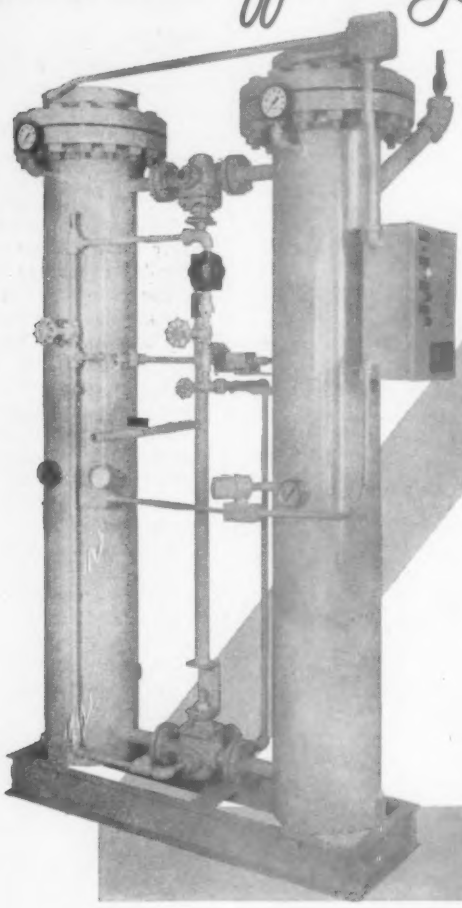
cut costs, add efficiency 4 ways!



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Set the program timer and everything is regulated automatically. Gases are dried with the least pressure loss, lowest maintenance and operating costs. Your choice of manual or semi-automatic systems, too.

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4 No moving parts

There are no blowers, fans or motors to create maintenance problems, rising operating costs. Unit comes fully assembled, ready to install and operate. Write today for Bulletin D-103, or contact your Kemp man, listed in the *Chemical Engineering Catalog*.

It always pays to come to

KEMP OF BALTIMORE

THE C. M. KEMP MANUFACTURING COMPANY
405 E. Oliver St., Baltimore 2, Md.

which discredit petroleum geology.

There is a need for drilling a certain number of more or less random holes to gain information; however, the tendency of companies to support and encourage too many tests having obscure, if any, geological background, reflects adversely upon the geological profession.

Petroleum geology is a service segment of the general petroleum industry. If the industry will be more exacting in its demands for quality, and constructive rather than destructive in its criticisms, the industry can assure itself of the finest geological service. Since it supports the profession, the industry can effectively set the standards for petroleum geologists.

Wilford L. Cline
Consulting Geologist
Wichita.

Another optimist

Dear Sir:

"Can We Do It Again," (OGJ, Jan. 4, p. 115) reminds me of some of my predictions some years back.

1960 will see much drilling activity and a number of new gas and oil fields, both east and west of the Mississippi River.

There is plenty of gas and oil yet to be found in the United States. Like you, I'm an optimist.

Dorsey Hager
Consulting Geologist
Salt Lake City

IOCC has more than fun

Dear Sir:

Because of another pressing engagement, I did not attend the fall meeting of the Interstate Oil Compact Commission.

According to your editorial in the December 21 issue (p. 41) everyone must have had a good time. I regret missing this feature as well as the formal meetings.

We have some pertinent items on the program of each of the next two meetings of the engineering committee of the Commission, which I am sure your readers would like to know about. These are:

June, 1960, Detroit:

1. Final report following distribution of a subcommittee report in book form, "A Manual for Back Pressure Testing Gas Wells." A substantial amount of the material in this forthcoming publication has already been utilized by various gas producing states and in certain areas of Canada.

2. Presentation of a paper by Dr. Eduardo A. Acosta H., director, Ministry of Mines and Hydrocarbons, Caracas, covering utilization and conservation of gas in Venezuela.

3. Consideration of a series of topics under development by the engineering committee and assigned to the leadership of Dr. H. H. Kaveler of Oklahoma on the regulatory aspects of engineering and conservation of gas reservoirs.

December, 1960, Phoenix:

1. Paper by James T. Cawley, deputy minister of mineral resources, Province of Saskatchewan, on gas conservation and injection projects, including storage, in Saskatchewan.

2. Paper by Dr. G. W. Covier, deputy chairman, Oil and Gas Conservation Board, Province of Alberta, on gas conservation projects in Alberta.

3. Paper by Ing. Alfonso Barnetche, manager of production, Petroleos Mexicanos, Mexico City, on gas conservation and utilization in Mexico.

4. Paper by Art Jersin, engineering committee member, on gas caps and the resultant conservation problems in gas fields underlying those gas caps.

W. H. Carson, Chairman
Engineering Committee
Interstate Oil Compact
Commission

Oil men take note!

"Here are a few things that I believe it will be necessary for the industry to do:

"It's going to have to put such serious problems as low allowables, shut-in production, etc., into perspective as part of this much larger problem of finding enough oil for the future.

"It's going to have to do some real thinking about and effectuate a program that will bring about efficiency in spacing, in drilling, in recovery.

"It's going to have to learn to look at itself as a single industry and not as a group of different industries.

"It's going to have to quit using so many double standards, such as importers who fight any restraint on foreign supply, but who wear their halos too tightly when they appear before the Railroad Commission hearing to endorse lower Texas allowables, and producers who think a market demand law is fine for every state except the one in which they operate.

"It's going to have to exercise judgment and maturity in its dealings with government."

W. M. Vaughey, partner, Vaughey & Vaughey, in a speech to the Oklahoma Independent Petroleum Association.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

LOSING MUD DURING DRILLING?

JELFLAKE

During drilling operations Jelflake® has proved effective in preventing mud losses to highly-permeable formations. Jelflake is fragmented plastic foil. The crinkled particles are scientifically graded to plug and plaster—to seal off thief zones. Operators find Jelflake effective in cementing operations too. Try Jelflake. Available in strong, wetproof bags at major mud distributors and Dowell stations.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

CALENDAR

JANUARY

31-Feb. 3 Pipe Line Contractors Association, annual meeting, Ambassador Hotel, Los Angeles.

FEBRUARY

1-4 Instrument Society of America, instrument-automation conference and exhibit, Rice Hotel and Houston Coliseum, Houston.

8 Alberta Division of Canadian Petroleum Association, annual meeting. Hotel Palliser, Calgary.

8 University of Texas and American Association of Oilwell Drilling Contractors, school of drilling technology, twelfth semi-annual term, Odessa. Term ends March 18.

8 University of Texas, American Petroleum Institute Division of Production, school of production technology, tenth semi-annual term, Kilgore College, Kilgore. Term ends March 18.

7-10 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Billings, Mont.

9-10 University of Oklahoma, advanced petroleum engineering seminar, Norman, Okla.

14-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Statler-Hilton and McAlpin hotels, New York.

18 Chemical Institute of Canada, protective coatings division conference, Toronto.

19 Chemical Institute of Canada, protective coatings division conference, Montreal.

21-24 American Institute of Chemical Engineers, meeting, Biltmore Hotel, Atlanta.

24-25 Wisconsin Petroleum Association, annual convention and exhibit, Schroeder Hotel, Milwaukee.

24-25 Oklahoma State University, technical conference on natural gas engineering, Stillwater, Okla.

25 American Chemical Society, Delaware Valley region petroleum symposium, Philadelphia.

24-26 National Association of Corrosion Engineers, Tulsa section, eleventh annual corrosion short course, Mayo Hotel, Tulsa.

26 Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

26 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

MARCH

2-4 American Petroleum Institute, Division of Production, southwestern district meeting, Statler-Hilton Hotel Dallas.

3-4 American Gas Association, Pacific Coast Gas Association, joint public relations conference, Biltmore Hotel, Santa Barbara, Calif.

4 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

6-9 American Society of Mechanical Engineers, gas turbine power and hydraulic conference, Rice Hotel, Houston.

7 Canadian Petroleum Associaton, annual general meeting, Hotel Palliser, Calgary.

7-8 University of Florida, annual heat transfer symposium, Engineering and Industries Building, Gainesville, Fla.

14-18 National Association of Corrosion Engineers, sixteenth annual meeting, Memorial Auditorium, Dallas.

16 Petroleum Equipment Suppliers Association, eastern district membership meeting, Duquesne Club, Pittsburgh.

16-18 American Petroleum Institute, Division of Production, southern district meeting, Hilton Hotel, San Antonio.

18 Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

21 University of Texas, school of gas technology, sixth semi-annual term, Kilgore College, Kilgore. Term ends April 29.

21-23 Midwest Gas Association, annual meeting, Hotel St. Paul, St. Paul.

22 Petroleum Equipment Suppliers Association, Gulf Coast district membership meeting, Shamrock Hilton Hotel, Houston.

24-25 New England Gas Association, annual meeting, Hotel Statler-Hilton, Boston.

25-26 North Texas Oil and Gas Association, thirtieth annual meeting, Kemp Hotel, Wichita Falls, Tex.

28 University of Texas, American Petroleum Institute Division of Transportation, school of pipeline technology, eighth semi-annual term, Lee College, Baytown, Tex. Term ends May 6.

28 University of Texas, American Petroleum Institute Division of Production, institute on automatic production controls, first term, Odessa College, Odessa, Tex. Term ends May 6.

28-30 Western Petroleum Refiners Association forty-eighth annual meeting, Hilton Hotel, San Antonio, Tex.

29-31 American Power Conference, annual meeting, Sherman Hotel, Chicago.

30-Apr. 1 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita.

APRIL

3-8 Engineers Joint Council, sixth nuclear congress, New York.

4-7 Oil Heat Institute of America, annual convention, Park-Sheraton Hotel, New York.

4-7 National oil heat and air-conditioning exposition, Coliseum, New York.

5 Petroleum Equipment Suppliers Association, southern mid-continent district membership meeting, Statler-Hilton Hotel, Dallas.

5-6 University of Kansas, eighth annual gas compressor institute, National Guard Armory, Liberal, Kans.

5-7 Instrument Society of America, national chemical and petroleum instrumentation symposium, Rochester, N. Y.

7-8 Rocky Mountain Oil and Gas Association, midyear meeting, Newhouse Hotel, Salt Lake City.

8 Chemical Institute of Canada, rubber chemistry division, annual meeting, Kitchener, Ont.

12-14 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, conference and exhibition, Municipal Auditorium, Kansas City.

19-21 University of Oklahoma, College of Engineering, southwestern gas measurement short course, north campus, University of Oklahoma, Norman.

More Capacity
per pump with
VIKING'S
new alloy
PUMPS
STAINLESS STEEL • MONEL • NICKEL • NI-RESIST • DUCTILE IRON • AND OTHERS
At new rated speeds, capacities are doubled in some cases, with the new line of Viking Heavy-Duty Rotary Pumps. On thin liquids, pumps are operated up to 100% rated speed. Resultant savings amount to as much as several hundred dollars.
These new rated speeds are possible because of our entirely new, modern electric foundry facilities and manufacturing processes. They enable us to meet more exacting requirements than ever before throughout the complete line of Viking alloy pumps.
If your specifications call for stainless steel or other alloy pumps, see how you, too, can save.
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In Texas, these unique supply facilities

for Du Pont tetraethyl lead customers

Refiners in the Gulf Coast and Mid-Continent areas are assured an ample supply and prompt delivery of TEL.

The Du Pont terminal at Beaumont, Texas, (top picture) contains complete modern equipment for TEL storage and handling. It also includes a rail siding for TEL tank cars, which are preloaded and ready for rapid dispatch on a twenty-four-hour basis.

A unique feature of the Beaumont terminal is that it is supplied by sea, with a specially-built TEL tank ship, the MV PETROCHEM, whose home port is Du Pont's largest TEL manufacturing plant, at Deepwater, N. J.

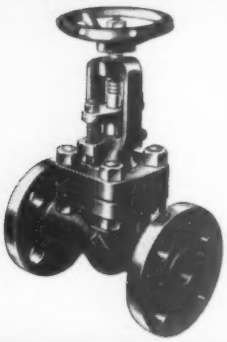
This unusual distribution facility is integrated with other Du Pont Petroleum Chemicals Division operations in Texas . . . such as additives warehouses and the regional sales and technical service offices and laboratories in Houston and Tulsa . . . to provide your refineries in the Gulf Coast and Mid-Continent areas with every possible service that may be required.

E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

Tetraethyl Lead
and other
Petroleum Additives



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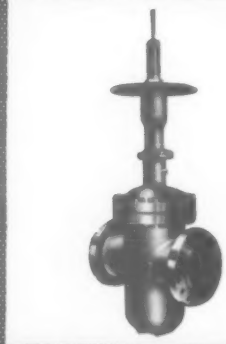

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LINE BLIND
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DOUBLE DISC
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ANGLE
and many other types

QUALITY:

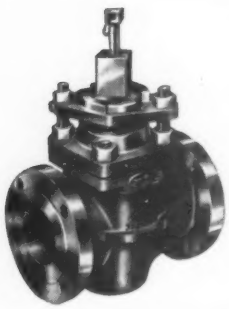
A very wide range of high quality valves in Cast Carbon Steel, Drop Forged Steel, Stainless and Alloy Steels to American specification.

SERVICE:

Immediate delivery and full advisory service.

PRICE:

You may be *valve* conscious, but are you *cost* conscious? You can save dollars on each installation. Call us and have us show you how.



* You may not be aware how much you might save by using Triangle valves—which are in world wide use in refineries and oil fields. We'd *like* you to know—why not have us call?

We're only a telephone call away
Murray Hill 8-0910

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TRIANGLE VALVE CO. LTD.

315 REGENT STREET, LONDON, W.1, ENGLAND. *Cables: TRIVALON LONDON*

Europe's largest manufacturers of steel valves for the oil and chemical industries.

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EUROPE'S LARGEST MANUFACTURERS OF STEEL VALVES FOR THE OIL AND PETROLEUM INDUSTRIES

TV8

the Journal said...

50 years ago

February 6, 1910

Prairie Valley Oil & Gas Co. is a new company formed to drill in search of the source of a strong oil seepage opened by a bolt of lightning that struck the ground on the Mrs. Josie Tinneborn farm in Beaver County, Oklahoma.

The Texas Co. starts surveys for a proposed oil pipeline from its Ardis station, near Shreveport, to its Garrison station, near Beaumont, on the Texas Coast. At Garrison, the new line will converge with lines from Oklahoma and Texas fields.

Disappointment of the people of Okmulgee, Okla., that oil supply companies serving nearby booming Preston field located their branch stores at Preston instead of Okmulgee is being soothed by proposals to build an electric trolley line to the field.

25 years ago

January 31, 1935

Wilshire Oil Co., one of California's larger independent marketers, lets contracts to Universal Oil Products Co. for building an entirely new refinery on its 250-acre tank farm at Santa Fe Springs. Initially, the plant will have a Dubbs cracking unit with capacity of 7,800 bbl. daily, and a distillation unit running 12,500 bbl. daily.

Standard Oil Co. of New Jersey reveals common-stock interest in Skelly Oil Co. and Tidewater Associated Oil Co. through the medium of Mission Corp. Dividend to be paid on basis of Skelly stock.

New Loma Novia field, east of long-stretching and prolific Government Wells field, in Duval County, looms as major producing area for Southwest Texas.

10 years ago

February 2, 1950

Atlantic Refining Co. develops new method of reservoir operation involving injection of gas at much higher pressures than ever before used in pressure maintenance or cycling. Greatly increased oil recoveries, possibly as much as 90% of the oil in place, are promised.

West Coast Transmission Co., Ltd., Calgary, Alta., waits export permit to lay 1,025-mile gas pipe line from Edmonton area of western Canada, to Vancouver, B. C., and Seattle, Portland, and other cities of the Pacific Northwest.

Four contractors share in contracts to redrill 135 earthquake-damaged oil wells in the Terminal Island area of Long Beach, Calif. Pike Drilling Co., Victory Oil Co., Camay Drilling Co., and International Drilling Co. expect to average seven recompletions per week.

JOURNALLY SPEAKING

You May Be Interested

YOU MAY NOT be as gratified about it as we are, but you may be at least mildly interested in knowing that you are reading the biggest magazine in this or any other world.

And if you like to study economic trends and business indicators, and learn where people spend their money, you might find some food for mental mastication in some statistics on magazine advertising just compiled by Industrial Marketing magazine.

That publication has developed its own index of business activity, based on the number of pages of advertising carried in various kinds of magazines. Granted it may not be as conclusive as the Federal Reserve Board's index of business activity, but it gets more attention in publishing circles.

The oil business, according to this index, is doing pretty well, but it certainly is not the fastest growing industry in the country. That title goes to the electronics industry on the basis that the group of publications in that field had a gain of 26% in the number of pages of advertising printed during 1959.

Following it were the instruments magazines with a gain of 19%, aircraft and space vehicles with 18%, motor freight and warehousing with 13%, schools and education services with 10%, hospitals, medical and health services with 8%, meat products with 8.5%, and then petroleum and gas publications with 7.7%.

You can reason this way: People who sell the most stuff do the most advertising, and the most advertising is done to people who have the most money to spend or the most need for goods. So you can deduce that the Government's defense budget is a big factor in the boom in the electronics, instruments, and aircraft industries. You can also see a reflection of the popular interest in health and education.

But you can also get an idea of the relative size of the petroleum industry in terms of buying power and money spent for equipment.

Now to get back to the biggest magazine in the world—us. We carried 6,877 pages of advertising in 1959. That's a gain of 7.4% over 1958. Industrial Marketing classifies us in what it calls the industrial group, and this group had a combined increase of 4% in number of advertising pages last year.

In case you are interested, other magazines at the top of the industrial group were Iron Age with 5,667 pages, Steel with 5,229, Electronics with 4,831, Aviation Week with 4,823, and American Machinist with 4,654 pages.

There are also some giants in what is known as the class group. Leaders here in 1959 were the Journal of the American Medical Association with 6,511 pages, Modern Medicine with 4,940, Medical Economics with 4,485, Advertising Age with 3,846, and Billboard with 2,806 pages.

The so-called trade group of publications also has some husky magazines. Leaders here were Florists' Review with 4,414 pages, Hardware Age with 3,142, Industrial Distribution with 2,200, Building Supply News with 2,121, and Sporting Goods Dealer with 2,071 pages.

Many people are surprised to learn that specialized publications like The Oil and Gas Journal and the others we have mentioned carry more advertising than most popular magazines of general circulation. So here, for purposes of comparison, are last year's leaders in that group: the New Yorker carried 5,055 pages, Business Week 4,702, Life 3,664, Newsweek 3,009, Time 2,913, and Saturday Evening Post 2,817 pages.

We said up above that you might be only mildly interested in the number of pages of advertising carried in the Journal. But there is one reason why you as a reader should be quite interested in our leadership in this respect.

A publication lives on advertising, and the more income it has from advertising, the more money it has to put into editorial manpower and services. It's having the most advertising that enables us to employ the largest editorial staff of any business magazine of any kind, and, we say without fear of successful contradiction, the best.

So don't groan that "the advertising gets in my way." Just remember that it's the advertising that makes it possible for the Big Yellow Book to bring you so much top-notch information about your industry week after week.

—Henry D. Ralph.

FOR PRACTICAL DUAL STRING COMPLETIONS

COMPARE THE SIMPLICITY, convenience and dependability of Baker Snap-Set Dual Packers with packers that depend on elaborate seals, valves and other intricate mechanisms.

Baker Snap-Set Dual Packers are easier to set than the simplest of hook-wall packers—just set down a slight amount of weight on the tubing to pack-off, simply pickup to release. They can be set and released as many times as desired without rotation, ball dropping or pressuring.

Baker Snap-Set Dual Packers offer full-opening through both sides for two strings of 2⅜" tubing when run in the popular 7" casing.

The Baker Model "J" Snap-Set Dual Packer is the ideal upper packer in a practical two-packer parallel string hookup, such as shown in the schematic at right. This hookup allows zones to be unloaded and washed after the well head is flanged up. Note that the vital separation of zones is provided by the reliable, time-tested, high-performance Baker Retainer Production Packer.

Baker Snap-Set Dual Packers are available with hydraulic button-type hold-downs where high differential pressures are to be encountered from below.

Ask for Catalog Supplement No. 357, which completely describes these packers and their use in selective-multiple zone completions, in addition to several popular dual-zone hookups.

BAKER SNAP-SET DUAL PACKERS
Shown is the Model "J", Single-Grip, Product No. 756-J.

Baker Parallel Snap-Latch Seal Nipple Product No. 707 (Not a Part of Packer)
Baker Single-Grip Snap-Set Dual Packer Product No. 756-J or Baker Double-Grip Snap-Set Dual Packer Product No. 757-J
Side Door Completion or Sleeve Valve
Baker Locator Tubing Seal Assembly Product No. 442-E2
Baker Retainer Production Packer Product No. 415
Baker Production Tube Product No. 457

CATALOG SUPPLEMENT NO. 357 describes Baker Snap-Set Dual Packers in complete detail.

BAKER OIL TOOLS, INC. HOUSTON LOS ANGELES NEW YORK

Antitrust laws—or antibusiness weapon?

IT IS IMPOSSIBLE to escape the conclusion that the administration is abusing the antitrust laws to make a political show and perverting them to stifle competition instead of fostering it.

It blocked the Texaco-Superior and the Leonard-Sohio mergers on flimsy allegations of reduction of competition. It settled the Gulf-Warren merger and the West Coast case against major oil companies with consent decrees that give the superficial appearance of protecting competitors but which, though a stigma and annoyance to the companies, won't really change their business practices.

In all these cases, and in others, the defendants said with justification they could have won clean-cut victories but wished to avoid the delays and expense of bitter court battles.

In three recent price-fixing allegations, involving drugs, investment bankers, and Middle East oil, the Government lost and was criticized by the courts for basing charges on suspicion and inference and for attacking normal, practical, business practices.

And throughout, the Government uses its publicity powers to smear the defendants in every possible way. Allegations of wrongdoing are ballyhooed, equivocal consent decrees are pictured as great victories, and announcements of defeats or of cases dropped are so worded and so timed as to get minimum notice.

THIS REVEALS A PHILOSOPHY opposed to economic growth and to the sort of free competition on which this nation has thrived and which the antitrust laws were designed to promote.

It reveals a hostility to business generally, a passion to inflame opinion against businessmen, and a disposition to use the laws as a club to castigate and hamstring business on the slightest pretext.

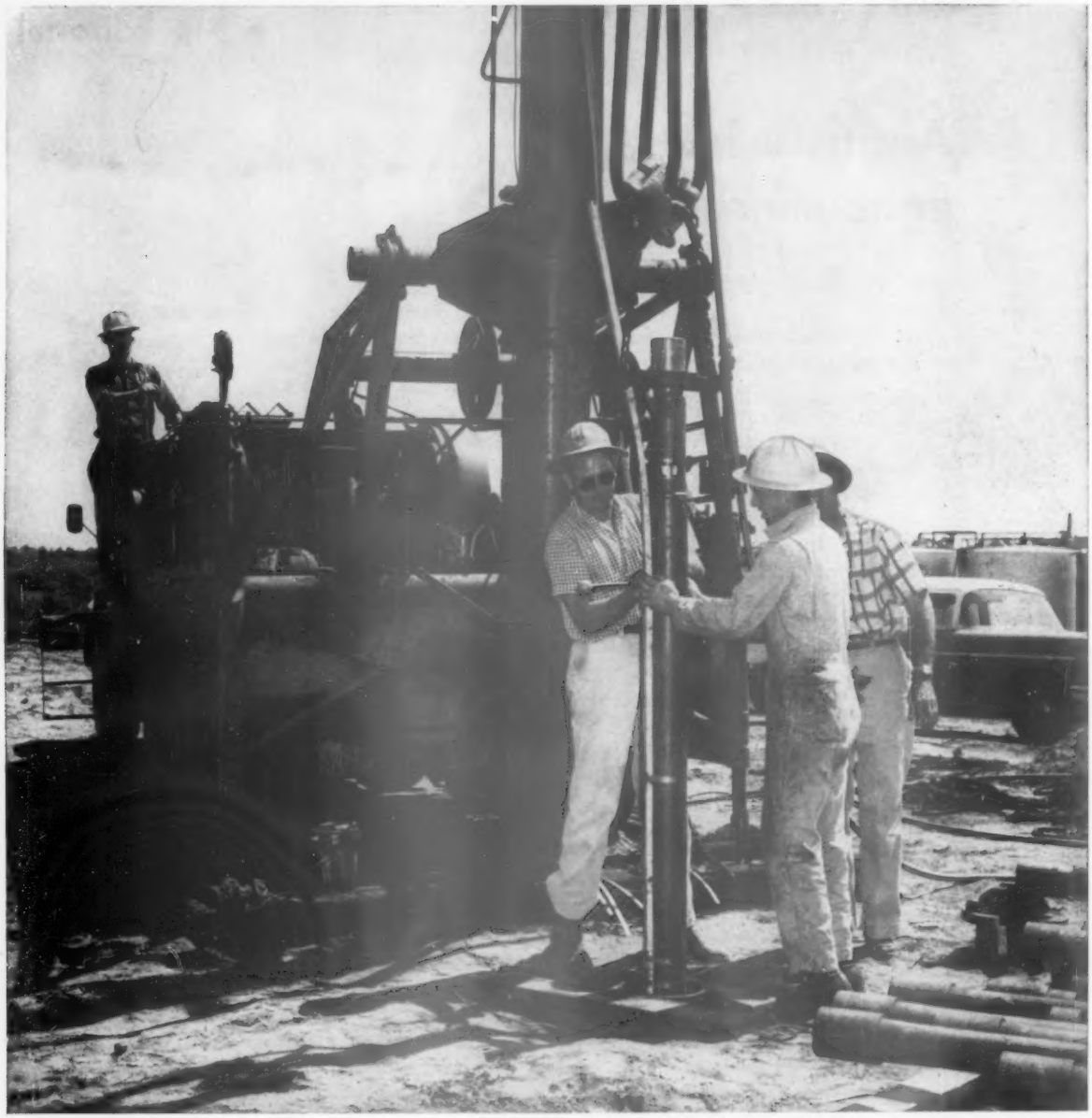
There is a fear of bigness as such, a distrust of the growth of business units in a growing economy, a denial of the efficiencies of central supervision and mass distribution.

This philosophy would freeze the business structure by preventing change or experiment. It would keep competition static and protect the inefficient by ponderously elaborate rules and stipulations.

When prices are uniform the allegation is collusion, and when they aren't the allegation is discrimination. This shows an utter lack of understanding of business practices and pricing factors.

WE NEED A RECLARIFICATION of the kind of competitive conditions we are trying to foster, the kind that makes business thrive and the economy grow. And we need antitrust administrators who understand and approve of it.

The antitrust laws are good but they are being warped and misused by legalistic dictators who are trying to mold the economy to fit their own unrealistic predilections.



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New Attacks on Marketing Coming

• There seems little danger of legislation this year, but four bills dropped into the hopper last week will give Roosevelt plenty of opportunity to keep up his running battle against the major companies.

IT IS beginning to appear that Rep. James Roosevelt (D.-Calif.) is going to make a career out of attacks on "big business"—with the major oil companies as one of his principal targets.

Last week he took the latest step in his campaign: He introduced three bills aimed at restricting oil and TBA marketing by integrated oil companies.

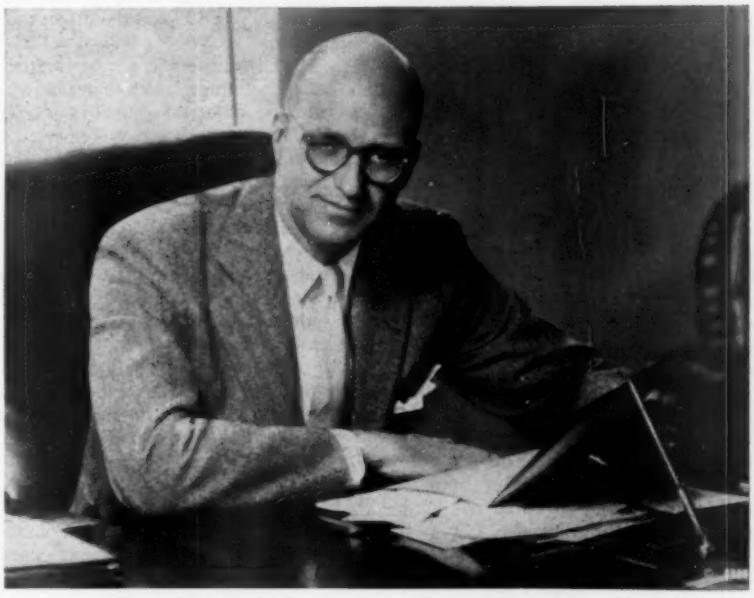
Of the three oil bills, one would be a long step toward outright divorcement of marketing from integrated oil companies. The second would bar oil firms from any participation in TBA marketing, and a third bill would require that supplier-dealer contracts be filed with the Federal Trade Commission.

Roosevelt has said that his proposed legislation would not affect independent oil jobbers.

A fourth bill, which would affect oil as well as other industries, calls for advance notification of mergers.

Roosevelt's crusade is not new, either with him or others. It was discovered long ago that there is political appeal in any campaign which claims to protect the small and the weak against the big and the strong.

In this particular case, Roosevelt is seeking to show that the independent service station operators and the independent TBA wholesalers are being crushed to death by the tenacles of the giant oil companies.



Rep. James Roosevelt: He still has a lot to say about marketing.

The chances . . . There appears to be little likelihood that any of the Roosevelt bills will be passed—at least not this year.

Roosevelt himself concedes that the general divorcement bill doesn't have much of a chance.

And the bill requiring reporting to the FTC will probably get scant consideration because it is a toothless piece of legislation. It would dump hundreds of thousands of contracts in the FTC's hands without giving the agency any power to do anything about them.

The proposal of pre-merger notification has been kicking around Congress for several years and has made little headway.

Therefore, the only one of the California congressman's bills likely to get much consideration is the one requiring divorcement of TBA marketing. And the odds are against the passage of this one.

Even so, there is little doubt that Roosevelt's actions will have some impact.

The significance . . . Even if he just gets a committee hearing on one or more of the bills, this will provide him with a platform for publicly recounting his charges against the oil industry.

If there are no hearings at all, he will still be in a position to try to prod the Federal Trade Commission into some investigation of oil's marketing practices.

And his subcommittee can continue to make periodic probes into the subject. It has been doing this, on an off-and-on basis, for 5 years now, and each time it succeeds in getting good publicity in the press.

Roosevelt feels that his investigations have already proved of benefit because they have aired the complaints of those who have been hurt, or feel they have been hurt, by the actions of representatives of major suppliers.

Roosevelt claims he has given the majors ample warning and ample time to correct any existing abuses, but he claims they haven't done so.

He thinks that the bills he has tossed into the congressional hopper

provide a remedy while leaving virtually undisturbed the companies who deal fairly with their retailers.

Divorcement . . . In the general divorcement bill, for example, provisions are made under which a major company can continue to have a role in retailing.

Although the bill specifies that, after January 1, 1964, no integrated company which sells oil products at wholesale can sell at retail, it does make these exceptions:

A major, or its affiliate, could continue to sell at retail if it dropped its wholesale activities.

Furthermore, existing contracts between a major and an independent service-station operator could be continued after January 1, 1964, as long as leases made prior to that date were still in effect.

Thus, if a 5-year lease were entered into just before January 1, 1964, the major would have that retail outlet until the expiration of the lease.

Obviously, the main point in this provision is to encourage long leases.

And there is still another provision which would make continuation of lease stations by a major possible: The leases could be continued as long as mutual agreement existed. And the leases could even be sublet to another lessor by agreement between the company and the original operator.

The key point in these provisions rests in the "mutual agreement" clause. If a major and a service-station lessor do not "mutually agree" on the continuation of the contract or upon a new lessor, the major could not lease the station to someone else.

This obviously would give the station operator a club to use against the major company for, if there was no "mutual agreement," the major would then be "divorced" from retailing.

As a staff member of the Roosevelt subcommittee put it, the bill does not force divorcement. Instead, it spells out the grounds for divorcement.

TBA marketing . . . The TBA marketing bill, however, does call for outright divorcement from TBA marketing.

It would make it unlawful for any integrated oil company that sells oil products at wholesale to act directly or indirectly as an agent, or to receive any commission from, any manufacturer or distributor of TBA items. The only way, then, that a company could profit from TBA retailing would be to drop out of the wholesaling end of petroleum products.

You will be hearing more from Mr. Roosevelt about these bills.

watching WASHINGTON

Clyde La Motte

• IPAA maps an ambitious program . . .

The Independent Petroleum Association of America is planning to find out just what is ailing the oil industry.

It is setting up a special committee which will seek to identify the problems, weigh their impact, and, if possible, suggest a solution.

Its intention at this point is to take a look at a wide variety of possible trouble spots. For instance, it will seek to determine whether there is too much drilling, particularly of development wells. It may study the impact of state conservation measures—or the lack of them in some areas.

The committee likely will look at the constantly increasing supply of crude oil abroad and the effect this has on U. S. markets, even with import controls.

The studies will not be limited to production. They will include a look at the refining picture to decide whether there has been too much expansion and too little self-control of refinery throughput.

The committee may very well get into the controversial issue of import quotas for inland refineries, probing the possibility that such quotas spur price cuts by refiners who are getting up to $1 or more per barrel in their swapping of their quota crude for domestic crude.

The IPAA is well aware that most of the problems it plans to dig into are not new ones. But it feels that not enough has been done to determine the size and nature of these problems in the over-all petroleum picture.

The committee hopes to have the cooperation of other segments of the industry in making these studies, for it is of the opinion that, in many cases, only an industry-wide approach has much chance of success.

The program is in the embryo stage. The size and makeup of the committee has not yet been determined, nor has a chairman been selected. But the association intends to proceed as rapidly as possible.

It is a sizeable undertaking.

• Oil's accent is on the negative . . .

One disadvantage the oil industry faces in Washington, and to some extent in its public relations generally, is that it is almost always on the defensive.

It must defend against attacks on percentage depletion. It must be on the defensive in the coal industry's campaign for a national fuels policy. It must oppose the antimarketing legislation being pushed by Rep. James Roosevelt (D.-Calif.) It must protest against the proposed hike in the gasoline tax.

In the present session of Congress, there will be little the oil industry will be advocating. Rather, it will be busy opposing various proposals.

This is unfortunate, even though it may be unavoidable, for it appears that the industry is "against" everything.

• Are gas prices "tilted" too much? . . .

The Federal Power Commission is voicing increased concern over the problem of "tilting" rates.

The "tilt" occurs in this fashion: In order to get, and keep, large industrial customers, a gas pipeline will lower its commodity rates on gas actually consumed, but will increase the demand rates which apply to residential and commercial customers.

The pipeline firms justify this on the basis that the industrial users take the gas on an interruptible basis, meaning that they are supplied during off-peak periods when much of the pipeline's capacity is not otherwise in use.

But the FPC says the rising cost of gas in the field is worsening the problem because it tends to put a heavier and heavier share of the cost on the residential and commercial consumers.

Price of Gulf Coast Gas Hits New High

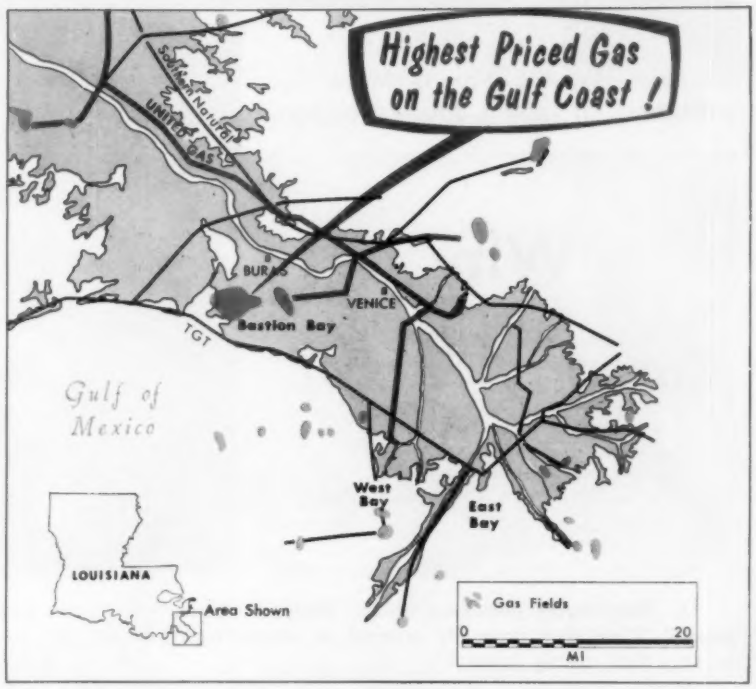
• United Gas Pipe Line will pay Gulf and Tidewater 22½ cents an M.c.f. at the wellhead for gas from Bastian Bay. This tops all other prices paid in the Gulf Coast. The only hitch: FPC must approve the sale.

ONE TRILLION cubic feet of gas in the most widely sought reserve on the Gulf Coast has been sold for record price to an interstate pipeline.

Gulf Oil Corp. and Tidewater Oil Co. have sold their reserves in Bastian Bay field, in Plaquemines Parish, South Louisiana, for an initial price of 22½ cents an M.c.f., plus full tax reimbursement. This pushes the gross price to 24.8 cents an M.c.f.

The price escalates to 25 cents on July 1, 1962. It is subject to redetermination each 5 years thereafter. The level is to be geared to an average of the two top prices paid for South Louisiana gas in the intervening period.

The purchaser, United Gas Pipe Line Co., earlier made the same deal with Gulf, Tidewater, and other operators for some 700 billion cubic feet in East Bastian Bay (OGJ, Mar. 30, 1959, p. 107). United moves some 60 million cubic feet daily from this pool for intrastate markets.



FPC hurdle ahead . . . If the Federal Power Commission approves the interstate sale at the contract price, it will set a new top for the Gulf Coast and Southwest.

It compares with 21½ and 22 cents in South Louisiana and offshore paid by Transcontinental Gas Pipe Line Corp. and 21.4 cents offshore paid by Tennessee Gas Transmission Co. Both the Transco and Tennessee deals, having once been approved by FPC, are back before the commission for a full-scale price hearing ordered by the U. S. Supreme Court.

The 23-cent price contracted by Transwestern Pipeline Co. in the Panhandle - Hugoton area of Oklahoma and Texas included 1.6 cents tax reimbursement. FPC conditioned these sales to 17 cents. They, too, are back before FPC on motion for a rehearing by producers (OGJ, Sept. 28, 1959, p. 56).

While the 22½-cent deal was the one finally accepted by Gulf and Tidewater in Bastian Bay, offers as high as 27 cents were disclosed in FPC testimony last year.

Pan Am still dealing . . . The Gulf-Tidewater sale still leaves a sizable block of Bastian Bay uncommitted.

Pan American Petroleum Corp. was reported last week still negotiating with another pipeline. Pan American is the largest operator in the field, with reserves estimated at 2½ to 3 trillion cubic feet.

Virtually every major pipeline on the Gulf Coast has made offers for all or part of Bastian Bay. The large reserve also has attracted buyers from as far away as California.

Proposals have been reported for a 30-in. project called Gulf Pacific Pipe Line Co. to transport Bastian Bay gas to California. Tennessee Gas Transmission Co. was linked with this deal as the builder of the pipeline which would provide transportation service for the gas. The proposed customer was Southern California Edison Co., Los Angeles.

Another proposition called for a swap with Texas Gulf Coast gas going to California and the Louisiana gas going northeast.

Both plans had the lure of a direct producer-consumer sale which would not be subject to FPC control.

The caution with which all producers, particularly Pan American, have dealt this reserve is due to its size and the muddled regulatory picture. A difference of 1 cent an M.c.f. will amount to millions of dollars over a 20-year period. At this point, there's still no forecasting the fate of an interstate sale. And there's no way of guessing the future attitude of FPC and the courts toward types of sales which are now considered to be outside federal control.

Pan American has therefore established a policy of promoting unregulated intrastate markets, and with no little success. But an intrastate customer for a trillion cubic feet of gas or more is hard to find.

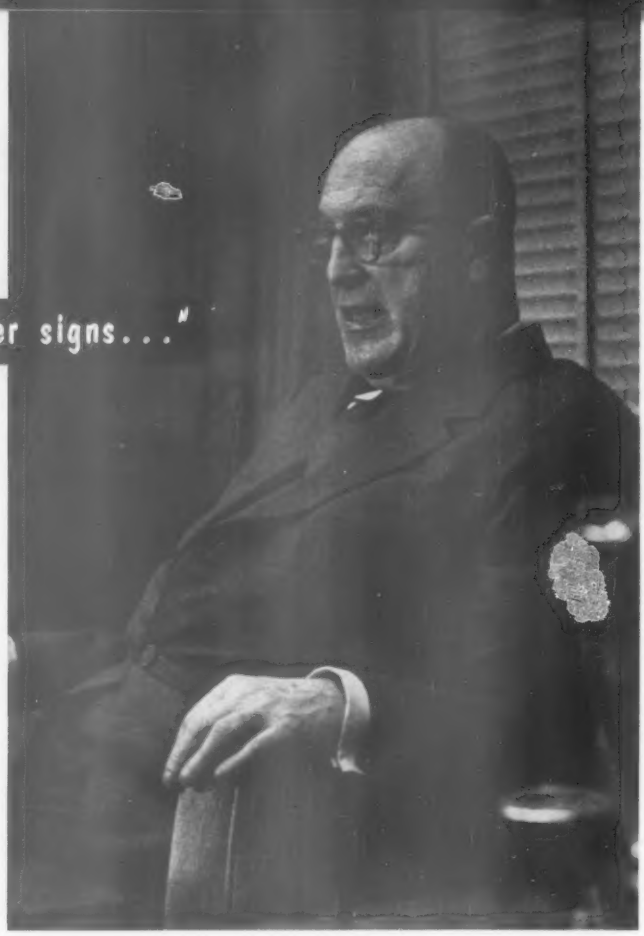
Pan American last year was able to make an intrastate deal of that magnitude. The company, with Mobil Oil Co. and other operators, sold reserves from Old Ocean field near Houston to Texas Electric Service Co., an electric utility, for an initial price of about 21½ cents an M.c.f.

This type of sale—direct to a power-generating company or other industry, bypassing gas transmission and distribution firms—has become increasingly popular with producers for disposing of large volumes of gas intrastate.

"Management saw some danger signs..."

. . . says Herbert Willetts, Mobil Oil president, in telling Journal editors

Why Socony Mobil Reorganized



Q. What forces prompted Socony Mobil to reorganize? Were they primarily external or competitive, or were they mainly internal?

A. The forces were both external and internal. In 1956, our best year profitwise, the management of our company saw several danger signals as we approached the end of the year. Competition was becoming increasingly keen throughout the world. It was becoming more and more difficult to recoup higher costs through higher prices.

There were other indications, but the sum of them was that the oil industry was moving into a new era, and Socony Mobil appeared to be somewhat less well equipped than it desired to deal with the problems that the future might bring.

As one phase of this effort to be prepared for the future, the management decided in the latter part of 1956 to study the ways in which the organization of the company might be improved.

Q. When was the decision made to reorganize and when will the plan be completed?

A. The first study covered the Socony Mobil domestic marketing department. It was completed early in 1958 and adopted in May of that year. Initial steps to make it effective were taken shortly thereafter. The organization in the Socony Mobil domestic marketing department was almost 100% completed early in 1959.

In December 1958, about a year after this broader study was begun, the board of directors adopted man-

This program digs deep

Toughening competition has forced many U. S. oil companies to take steps to improve efficiency and cut costs. One program that has dug deeper than most is that of Socony Mobil Oil Co., Inc.

Socony has reorganized its entire corporate setup by merging its affiliates into one U. S. company, Mobil Oil Co. These affiliates included Magnolia Petroleum Co., operating primarily in the Southwest; General Petroleum Corp., on the West Coast; and Mobil Producing Co., which operated primarily in the Rocky Mountains.

Mobil Oil now takes in the U. S. and Canada. A second new company, Mobil International, handles all the companies' operations in the rest of the world. Socony Mobil is the corporate parent of both.

To find out precisely why and how Socony did all this and what it expects to accomplish, the Journal asked Herbert Willetts, president of Mobil Oil, some frank questions.

His almost equally frank answers in a straightforward interview are reproduced here as a matter of interest to the industry.

"We looked back to our best year . . . and saw that notable changes were taking place"

"We decided to prepare for things we foresaw . . . which would be with us for years ahead"

agement's recommendations for a new organization plan for the whole company. This plan, which went into effect on March 1, 1959, substantially revised the corporate organization structure, and created two operating divisions—Mobil Oil Co. for the United States and Canada, and Mobil International Oil Co. for the rest of the free world.

A detailed organization plan for Mobil International was adopted and went into effect at the same time as the corporate plan.

Only a skeleton plan for interim organization of Mobil Oil Co. was adopted then. Intensive studies of the company's interests in the United States and Canada began immediately, with the objective of recommending a detailed organization plan at the earliest date consistent with careful consideration of all factors involved.

We expect the major phases of Mobil's reorganization to be completed not later than March 31, 1960. This does not mean that the total job will be completed by that date, but it's on the rails.

While Magnolia Petroleum Co., our former affiliate in the Southwest, was merged into Mobil on September 30, 1959, General Petroleum, our West Coast affiliate, and Mobil Producing Co. were not merged with the parent company until December 31, 1959. So, of course, there is a considerable amount of work still to be done in the areas of those former companies, particularly in connection with our producing operations. We now expect to complete the great bulk of this reorganization work by the end of March.

Q. Since the first reorganization occurred in Socony Mobil marketing, can this be interpreted to mean that marketing was most in need of reorganization?

A. No, I wouldn't say so, but it was the logical place to start because you feel the competitive pinch in marketing at least as quickly as in other areas of the business.

Q. Does the fact that Mobil of Canada was made a part of Mobil Oil rather than Mobil International indicate that Canada is regarded as an integral part of U. S. operations?

A. Mobil Oil of Canada will remain a separate company. It seems to us that the Canadian oil industry has a closer tie to the United States than to our other international operations. Mobil of Canada is, as you perhaps know, chiefly a producing operation.

Q. Is this also true of pipelines?

A. Our pipelines in the United States have not been merged into Mobil Oil. Our crude and product systems in the eastern and central parts of the United States have become part of Magnolia Pipe Line Co. We have a small pipeline system on the West Coast, which has been a part of General Petroleum, and we are presently studying its future operation and placement in the organization structure.

Q. Is it correct to say that the whole plan is a twofold operation, merging counterpart divisions of

Why Socony-Mobil Reorganized . . . starts page 62

"This is an attempt to be competitive—to make a profit under altered circumstances"

the affiliated companies as one goal and greater efficiency within divisions as another?

A. There is only one goal. Mergers are not planned for mergers' sake, but to improve over-all effectiveness.

Q. Why were the outside consultants brought in?

A. We talked originally of doing the job ourselves, but decided to use outside consultants, in order to secure increased objectivity, and to save the time of our principal management people. The business had to continue to run while all this was going on.

We chose McKinsey & Co. to assist us in this work. I want to make clear, however, that this was a Socony Mobil and Mobil Oil effort, and the final decisions in every case were ours. We do feel, however, that the assistance and advice we received from our consultants enabled us to do the job more quickly than if we had attempted to do it without them.

Q. Will certain functions be the exclusive responsibility of the parent corporation, or will Mobil Oil have its own departments such as economics, public relations, employe relations, etc.?

A. Research, engineering, and economics will remain in the parent company—Socony Mobil. Public relations will also remain in the corporate organizations. None of these functions will be duplicated in the divisions. We feel this will provide more effective coordination.

Employe relations, however, is somewhat different. Mobil Oil has its own employe-relations department and will have local employe-relations managers and limited staffs wherever we have a concentration of employes.

Q. Have any facilities such as plants, offices, terminals, etc., been eliminated? Are any to be eliminated later?

A. Physical facilities, generally, will remain about the same. Some offices will be eliminated. On the other hand, we have opened some additional offices—such as our producing division offices in Houston, Denver, and Midland. We have eliminated some offices —in Billings, for instance.

We are operating with a smaller number of division sales offices than we had previously. We eliminated division offices in Milwaukee and St. Louis and have merged the Buffalo and Albany division offices. We have opened a new division sales office in Minneapolis.

We are now covering the exploration and producing areas in the country with fewer exploration and producing offices and with fewer people.

Q. There must be separate objectives for each of these new divisions. Each, we assume, is expected to improve volume and reduce costs. Can you tell us how this is expected to be accomplished?

A. (With a chuckle.) I don't believe I should define these explicitly. My competition doesn't do it for me. Each of these divisions, of course, has its own set of objectives. All are a part of the general Mobil Oil plan, which in turn ties in with the Socony Mobil objectives. We have specific objectives agreed upon, for example, for 1960 in each division.

Q. What has been the total reduction in payroll so far? Can you estimate what it will be when the reorganization is complete?

A. We like to think of this in terms of better use of people rather than a reduction in numbers. There will, of course, be some reduction in personnel. In fact, some reduction has already taken place, and there undoubtedly will be more.

This is the toughest part of the job. It always is. It is, however, also the most important part of the job since everything we do is done through people. We believe this reorganization is going to permit better use of people. While we expected some reductions in personnel, we also expected a great many promotions. And that is what has happened.

With several separate organizations, as we once had, it was difficult to deploy and employ our people most effectively for their own development and to the best advantage of the corporate group as a whole.

Thinking was too stratified because people working for affiliates were Magnolia people or General Petroleum people. Now they can look for opportunity wherever it may be any place in the world.

Q. This caused some shock to employe morale. What have you done to restore it and what do you think the final results of your efforts in this area will be?

A. In the initial stage there was some shock, but I doubt if it was as great as you may think.

We talked frankly to people all over the country and kept them advised of our plans. That initial shock changes pretty quickly when dealt with frankly. Our people soon could see our need to place ourselves in a better competitive position.

With fair treatment, we tried to take care of the surplus in every way we could. Early retirement was one method. Good communications and complete frankness helped.

Q. Has the reduction in employment been across the board? As much, proportionately, among executives as among clerks and operators?

A. There were reductions in several groups, including executives.

Q. How great a part will electronic computers play in achieving this new and improved coordination?

A. We are using electronic computers for solutions to a great many of our problems. They will be used much more in the future than they are today. We have a large center here in New York. It is linked to another at Dallas, and there will be another in Los Angeles.

Q. This step must have a specific objective. Can it be defined in other than abstract language, as a per cent improvement in return on sales or assets?

A. Our essential concept was a single business. We coordinated Mobil Oil operations in the United States to the benefit of the whole company.

Effective coordination will save considerable executive time and company expense. Mobil will be in a better position to take full advantage of competitive situations that bring long-term profits. The organization will permit us to continue our efforts to achieve optimum efficiency and avoid being squeezed between higher cost levels and prices which do not reflect the increased costs.

I've said it many times. It's difficult for a company to exercise any control over the prices it is paid for its goods. It can't, of itself, influence demand to any real extent. It can influence total supply only a little. What it can do to affect its own profits is reduce costs.

I feel rather sanguine that we have acted in the interest of shareholders, the great majority of our employes, and the public.

LAND OF CONTRASTS is what oil men are finding in Alaska. In winter, Anchorage citizens stage a festival known as the Fur Rendezvous in which dog-team racing on the main street for a $6,500 purse is a big event. In summer, families enjoy picnics and swimming at Goose Lake across from the new university.

Oil Men Find Alaska Costly

. . . with living expenses 50% higher than in Seattle. But their families discover life is pleasant in the Far North, too.

IF THE BOSS says you're moving to Alaska, it's not exactly a sentence to Siberia.

Many oil men and their families have seen service in the forty-ninth state in the last few years, especially since late 1957. Richfield Oil Corp.'s Kenai discovery started a new influx of oil people connected with reconnaissance, leasing, drilling, and services.

They have found life in Alaska a little more expensive but not too much different from that in other northern states. There are plenty of compensations, too, for the high prices.

Place to live . . . The first decision facing a new Alaskan is finding a place to live—and that may be tough.

Wayne Davison, former stateside geologist who recently became a consultant in Anchorage, said for those not fully acquainted with conditions

in Alaska the job of finding living accommodations may seem a greater problem than it really is.

"Living conditions here are just as modern and up-to-date as can be found anywhere," he said.

Housing, however, comes high. It's probably the most expensive item in the higher cost of living in the far north.

Apartments rent from 50 to 100% higher than the same accommodations would cost in a metropolitan center in the other states. The supply isn't too plentiful either, but this may change.

Housing units in Anchorage totaled about 6,000 in 1950 and have increased to more than 18,000. Rentals range from $180 to $275 a month.

The cost of an average modern two-bedroom home ranges from $18,000 to $30,000.

Most oil companies and independents have picked Anchorage for their headquarters. Explanation for this simply is that Anchorage now is the major city of Alaska, center of the most populated area of the new state, and has the facilities to serve the industry. Other Alaskan cities, especially Fairbanks, may become oil centers if the oil industry develops there as expected.

This rapid growth of Anchorage has contributed to the housing shortage. But this shortage is no worse than many oil people have experienced in many oil areas farther south.

Cost of living . . . Statistics gathered by various surveys indicate the cost of living in Anchorage is about 50% higher than it is in Seattle.

Many factors influence this, but the major one is transportation. Practically everything — all consumer goods, building materials, automobiles, equipment, or you name it—must be transported great distances into Alaska. This freight cost is the main difference between costs in Alaska and in the lower 48 states.

Food prices are about 25% higher. Some vegetables and other items grown in nearby valleys actually are as cheap in season as they are in other states.

Average price for a business man's coffee at a cafe is 10 to 15 cents, with the second cup free. At the supermarkets, coffee is 69 to 79 cents per pound; lettuce 29 to 45 cents per pound; milk 79 cents a half gallon; eggs 59 cents a dozen; bread 50 cents a loaf; and bacon 69 cents a pound. Canned goods generally are 10% higher than in Seattle.

A quick look at other items:

Haircuts $2.50; movie tickets $1.25; bowling 60 cents a line; automobiles and furniture about 25% higher; gasoline from 39 to 45 cents a gallon; motor oil 60 to 75 cents a quart; heating costs about $40 month for the average home.

Living conditions . . . Alaska is not the frozen Arctic waste so often pictured.

Anchorage has a climate similar to the northern Great Lakes region. Average temperature for January is 13° above zero and for July 57°. Seldom does the temperature reach the 80's in the summer. Average rainfall is 14.27 in. and average snowfall 59.7 in.

Anchorage has fine schools, churches, and shops to serve a city of 100,000. It's the transportation center for the Alaska railroad, highways, and airlines. Anchorage airport had the third largest volume of air traffic of any city in the U. S. in 1957.

The city has two television stations, two newspapers, three radio stations, a fine library, community college, community chorus, little theater, symphony orchestra, and two hospitals.

Recreation is plentiful at ski, hunting, and fishing resorts. Big investments in new facilities to attract tourists are being made, and recreation some day will be big business in the new state.

Big question for the oil man often is: What shall I take or leave behind?

Davison, who experienced the same decisions only recently, gave these tips:

. . . Personal belongings or household goods. If they are hard-to-replace items, or cherished possessions, ship them. Often it's more economical to leave heavier, bigger household items behind and buy anew in Alaska.

. . . Automobile. It's not out of the question to ship a car, but it's far cheaper to drive it in over the Alcan highway. Winter probably is the better time to drive because snow cushions the loose gravel and covers the dust which make driving tough in the warmer months.

. . . Clothing. Better wait and buy heavy winter clothing in Alaska. Alaska has a summer, and light-weight clothes may be used but not as extensively in the other states.

. . . Employment. Better not move to Alaska unless you have work assured because Alaska has an unemployment problem.

Wasson Field Miscible Pilot Looking Good

SHELL OIL CO. has completed LPG injection and now is forcing 130,000,000 cu. ft. of gas daily into the San Andres in its important miscible pilot in West Texas' Wasson field.

If the pilot performs as hoped, it could be extended over much of the big field's 63,000 acres.

Shell engineers feel that it will be successful. A highly detailed study of the reservoir indicates that a large portion of it is amenable to the miscible technique. The study showed the San Andres is well-connected between wells and that permeability stratification is not severe.

The test is under way on Shell's 640-acre Baumgart "E" lease in the eastern portion of the field near Denver City in Yoakum County. It is an inverted, 160-acre five-spot pilot with the injection well, Shell's E-2 Baumgart, in the center.

Allowables of all wells on the lease have been transferred to the four producers in the pilot—the Baumgart "E" 4, 10, 13, and 15.

Project engineers feel it will be at least a year, perhaps two, before they will be able to tell much about success of the test. The results will help guide Shell, the largest operator in the field, on what field-wide program to propose to other operators.

There is a lot of room for improvement in oil recovery at Wasson.

Though the sprawling field has already produced roughly 350,000,000 bbl. of oil, Shell predicts total primary recovery will not exceed 20% of oil originally in place.

This means that the giant San Andres reservoir probably contained more than 2 billion barrels of oil initially.

Wasson now is 23 years old and fully developed. It extends about 15 miles east-west and about 11 miles north-south in southern Yoakum and northern Gaines counties. It boasts 1,754 wells which still produce about 80,000 bbl. of oil a day from dolomite topped at about 4,700 ft.

Oil column ranges from 200 to 250 ft. thick, with a 100-150 ft. gas cap in the southern area.

If the miscible plan, with its high displacement efficiency, should prove suitable for much of the field, Wasson operators would be in position to reap quite a bonanza of secondary oil.

Gas Field Off Texas Coast Run From Shore

• Mobil's microwave set-up controls output of seven offshore gas wells.

MOBIL OIL CO. has installed a new push-button microwave system to control gas production from seven wells 25 miles out in the Gulf off Sabine, Tex.

The new system, designed and installed by Mobil engineers, will shave substantially the high cost of producing and operating offshore.

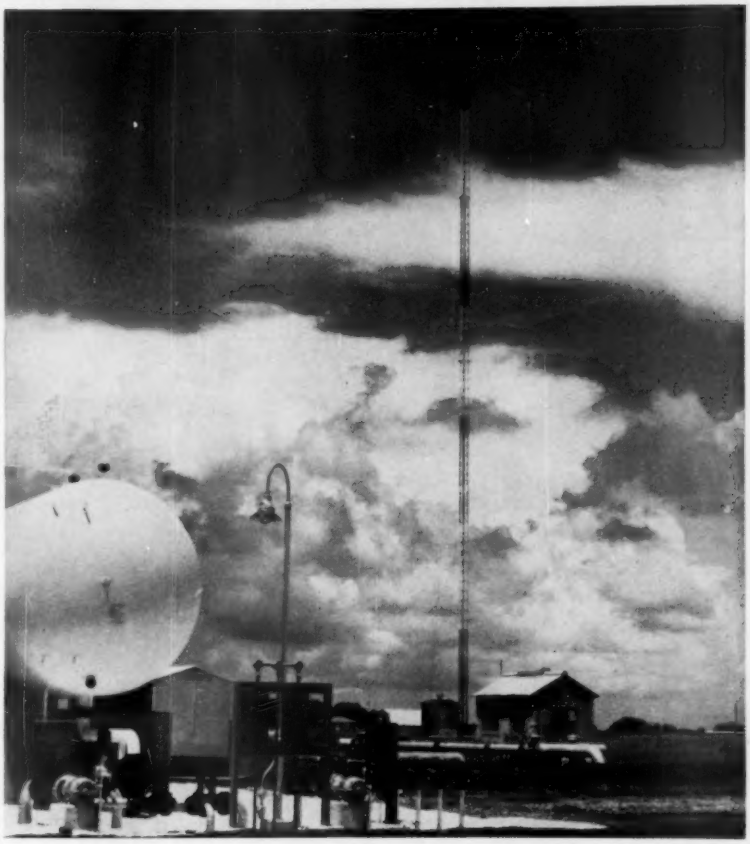
Production is controlled from Mobil's big gas distillate separation and recovery facility on the Louisiana coast at Cameron. Two microwave towers, one at Cameron and one on the offshore platform, relay operating instructions from shore to the equipment in the Gulf.

From Cameron, Mobil personnel open and close in the seven gas wells individually, adjust flow volumes, check on critical pressures and temperatures, and spot any trouble that might develop on the platform.

The same functions under conventional operation would be handled by two men living on the platform.

With the new remote-control setup, Mobil will send a man to the platform only about once a week to change charts and do normal maintenance work.

The seven wells currently are producing about 5,000,000 cu. ft. of gas daily. The gas moves to the Cameron processing facility through a new 10-in. submarine line.



The Sabine Pass remote-control system will serve as a Mobil guinea pig. It will be studied closely by Mobil engineers. And, if it proves as successful as expected, similar remote systems likely will follow for other Mobil offshore operations.

Microwave and supervisory control equipment was supplied by RCA, with design and installation both Mobil.

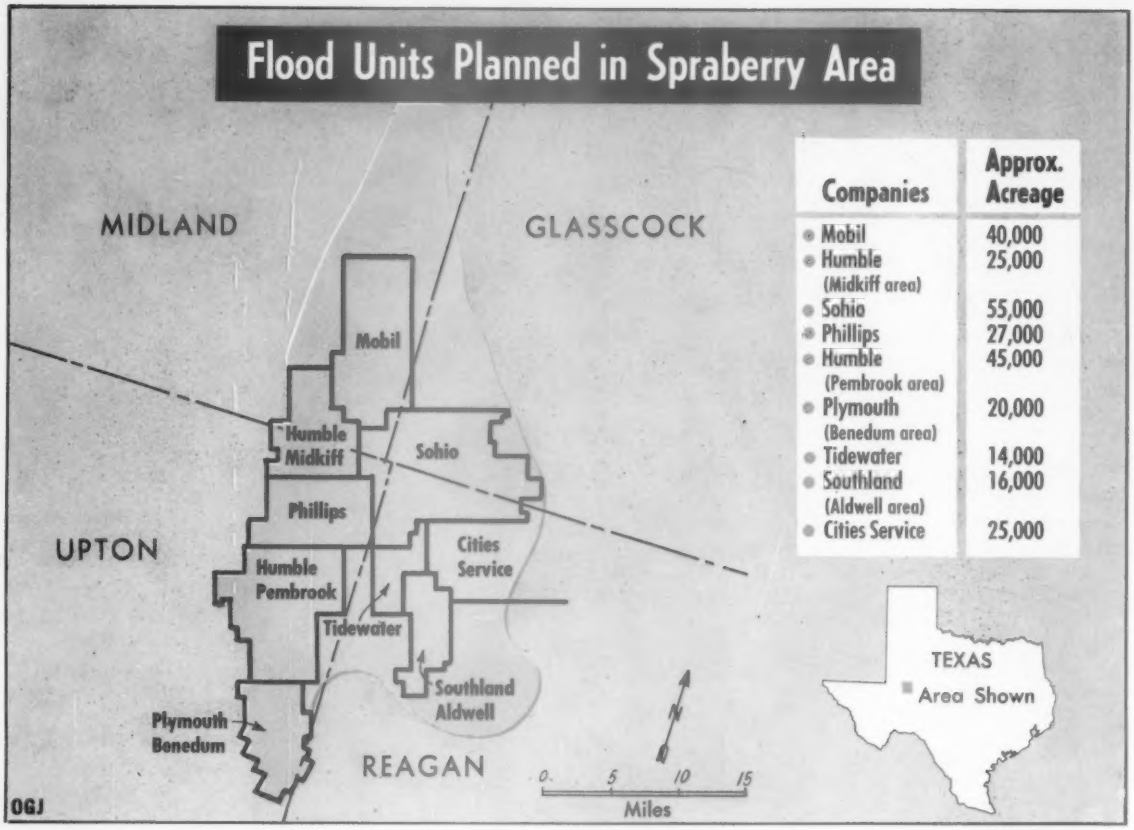
INDUSTRY BRIEFS . . .

A Texas appeals court held in Austin last week that natural gas produced after cycling operations have ceased is subject to the state's gas-production tax. The decision, by the Third Court of Civil Appeals, affirmed a district-court ruling. The suit was brought by Francitas Gas Co. to recover $116,720 paid under protest since July 1950. The gas in question is produced from Francitas field in Jackson County. The Texas gas-production tax now stands at 7% of wellhead value.

Lawsuits attacking Texas' new severance-beneficiary gas tax continue to pile up. Last week, 10 more were filed, bringing the total up to more than 40. So far, the state has collected more than $2,000,000 under protest from 279 companies for the 3 months the tax has been in effect. It has taken in only about $10,000 a month not paid under protest. A test case now set for trial February 15 in the State District Court at Austin and involving six companies is expected to settle most of the issues involved in all suits filed to date.

Kansas gas purchasers contend ratable taking is adequately effected under present commission rules. In a hearing in Wichita last week, industry spokesmen generally agreed current proration orders permit each lease to produce the gas under it, and that wells are produced in relation to wells surrounding them. The commission is considering a new proration rule that would require each pipeline company to take ratably throughout its system. The hearing grew out of an order by the commission for Northern Natural Gas Co. to take ratably from wells to which it is connected. Claiming prior contracts, Northern has taken the order to district court.

The State of Georgia, still looking for its first commercial oil well, can expect a new wildcat in February. Ernest Hill, Houston independent, said he will spud shortly on a 1,500-acre lease a few miles northwest of Americus, in southwest Georgia. Two dry holes have been drilled some 10 to 15 miles from the spot where the proposed well will be located. No depth has been set for the test, but Hill expects to go to around 4,000 to 6,000 ft. Hill has about 10,000 acres in four blocks under lease.



First Spraberry Floods Near Kickoff

• Operations in one unit expected to get under way first part of summer and two more may be in business by year's end. Nine units are in the works, and tentative boundaries take in about 280,000 acres.

FULL-SCALE water flooding in Spraberry Trend Area field will start this year.

Three large units in the giant field are nearing reality. And others are not far behind.

First large flood to go into operation probably will be that ramrodded by Southland Royalty Co. in the southeastern portion of the field.

Southland, operator of planned unit of about 16,000 acres, likely will start injecting water about the first of June.

The huge unit now being pushed by Sohio Petroleum Co. should also start up before the end of the year. The Sohio project likely will wind up taking in about 85 sections or 55,000 acres in the Driver area or east-central part of the field.

Humble Oil & Refining Co. is pushing along on a virtual crash basis to flange up a unit of about 25,000 acres in the Midkiff area of the field.

Humble already is circulating its unit agreement and contacting royalty owners. And this unit, too, may be in business before year's end.

Others coming . . . Besides these three, there are six more big Spraberry Trend flood projects moving toward unitization.

And prospects are that the great bulk of the sprawling field will be under flood within the next 2 years.

The nine units now planned (see map) take in roughly 280,000 acres.

Operators of the other six units now in the works include: Mobil Oil Co., Humble (a second unit in the Pembrook area), Tidewater Oil Co., Cities Service Oil Co., Phillips Petroleum Co., and Plymouth Oil Co.

Southland project . . . Southland Royalty now has signed up roughly 93% of the working interests and 76% of the royalty interests in its planned unit area.

This is enough to conform to the unofficial yardstick used by the Texas Railroad Commission before it will consider a unit proposal. Southland is expected to apply for a unitization hearing before the end of January.

The project it will propose will cost the 14 operators in the unit area roughly $2,500,000.

The initial flood will take in 110 wells producing from the upper and lower Spraberry zones in a 9-mile by 3-mile patch of the field in northwestern Reagan County. Southland, as operator, intends to flood the lower Spraberry sand pay first, then the upper Spraberry. Plans are to drill five water-input wells and perhaps three more producers.

So far, wells in the unit area have produced around 10,000,000 bbl. of oil. Southland estimates that only

about 2,000,000 to 3,000,000 bbl. is left to be produced by primary means.

Engineers estimate the flood will hike total recovery from the unit area by about 19,000,000 bbl. of oil.

The Southland project, so far as is known, is the first to be attempted in a heavily fractured formation on such a large scale.

Pilot work by Atlantic Refining Co. and Humble Oil & Refining Co. proved to most operators' satisfaction, however, that such operations can be commercially successful.

Southland was assisted in its flood planning by the U. S. Bureau of Mines, which conducted a radioactive tracer survey to determine fracture orientation in the Spraberry in the unit area.

Sohio moving, too . . . Sohio, too, is rapidly gathering signatures of working and royalty interest holders for its much-larger unit.

A company spokesman told the Journal last week that 78% of the working interests and 65% of the royalty holdings already have signed the unit agreement since contact work first started early in December. This is remarkable progress for a unit area so large and with ownership so scattered and diverse.

Sohio, as yet, has no tentative date in mind for going to the Railroad Commission, however.

It's estimated that extra oil recovery via flooding in the Sohio area will run anywhere from about 30,000,000 to about 80,000,000 bbl. from the upper Spraberry alone. And the lower Spraberry underlies a large portion of the area as well.

Sohio plans to limit the flood at first to a pilot operation under nine sections and to expand it over the entire unit when the results warrant.

Need for haste . . . Meanwhile production in Spraberry continues to nosedive — although not as fast as some operators had anticipated a couple of years ago.

Last fall, the huge field was averaging around 880,000 bbl. of oil a month. This is only about half as much as it was producing in early 1956.

Many wells in the field would already have been plugged if their operators were not holding on due to flood expectations. Some are down to as little as 1-3 bbl. daily.

This is true even in the Pembrook area which many had earlier believed would prove to be the best portion of the field. Some wells in this area, one operator told the Journal, are now making as little as 70-75 bbl. a month—or only about 2 to 2½ bbl. a day.

These, of course, aren't economic producers. And they would be plugged now were it not for the pending floods.

Aneth Well-Spacing Decision Is Near

• Ruling on 80 or 40-acre spacing for Greater Aneth could come from Utah Conservation Commission within month after hearings are wound up. The question has been kicked around for more than 2 years.

THE LONG, drawn-out controversy over spacing in Utah's Greater Aneth field is heading down to the wire.

A decision may be made this month on whether 80-acre well spacing will be continued, or if the huge field will be drilled down to 40-acre spacing.

Hearings in the case, which dates back to the fall of 1957, were being wrapped up last week. The Utah Oil and Gas Conservation Commission has stated it will hand down its ruling within 30 days after the hearing closes.

The hearing reconvened at Salt Lake City on January 26 after a 2-month recess. Starting up where they left off, Shell Oil Co. witnesses last week testified that 40-acre spacing is needed to adequately drain the field's two main pay zones.

In the 2-week session last November, proponents of 80-acre spacing—Carter Oil Co., Phillips Petroleum Co., Texaco Inc., Continental Oil Co., and Superior Oil Co.—testified the added wells would result in little additional oil being recovered (OGJ, Nov. 23, 1959, p. 53; Nov. 16, p. 135).

The job of the Utah Commission in deciding whether it's to be 40 or 80 acres will not be an easy one. The length of the hearing—longest well-spacing hearing ever—indicates the complexity of the problem.

Shell's Side . . . From five test wells drilled on 40-acre spacing, Shell engineers have concluded that 40-acre spacing would recover an additional 60,000,000 bbl. of oil.

The test wells failed to find the virgin pressure conditions Shell had hoped to find in the better pay zones. Reservoir pressures at the intermediate locations, however, were far too high for there to be good communication to the surrounding 80-acre spaced wells, Shell engineers claim.

Based on the net pay found in the five test wells, Shell's William Miller, Farmington, N. M., testified the 40-acre spaced wells would result in 160,000 bbl. more oil from each 80-acre unit. As the test wells had slightly more pay than the average Aneth producer, he placed the amount at 140,000 bbl. for the average undrilled 40-acre location.

As an example of the lack of communication between a 40-acre infill and surrounding 80-acre wells, Shell reported one of the test wells flowed 11,000 bbl. of oil on a production test. It flowed an average of 300 bbl. daily, while a 150-bbl. average was being pumped from surrounding older producers during the same period.

Field-wide pressure studies made by Shell showed that pressure differentials of hundreds of pounds per square inch between adjacent wells were quite common. Calculations made from these data have caused Shell engineers to conclude that 80-acre spaced wells have effective communication with only one-half or two-thirds of the total oil in the field.

Proponents of 80-acre spacing are seeking to disprove these findings. In contrast to Shell's claims that a primary oil recovery of 25% will be obtained, the 80-acre proponents state that only 12 to 16% will be obtained —regardless of spacing.

Water-flood hearing . . . The well-spacing controversy will scarcely be settled when a new one starts on the feasibility of water flooding.

Operators are divided into three camps on this issue, which will be heard by the commission in March.

One group, headed by Superior, claims that water flooding should be started now, while pressures are in the range of 1,900 psi. Another group believes that 1,000 to 1,100 psi. is the optimum pressure for flooding. Still another thinks that most oil will be recovered if reservoir pressures are permitted to drop to about 200 psi. before flooding is started.

Take Your Pick

SIGNAL OIL & GAS CO. isn't wasting any time in expanding its multigrade gasoline marketing program in California. The company currently is converting stations of its two marketing affiliates, Hancock and Norwalk, to seven-grade stations. The converted stations are cropping up throughout Central California's San Joaquin Valley. Signal expects to have about 115 stations selling multigrade gasolines when the expansion is completed.

The company is a comparative newcomer to multigrade marketing. It opened its first station in Nevada last summer. The success in Nevada led Signal to bring multigrade marketing to California a few weeks ago — and now Signal is moving rapidly ahead by converting more Hancock and Norwalk outlets.

Defense Strategy

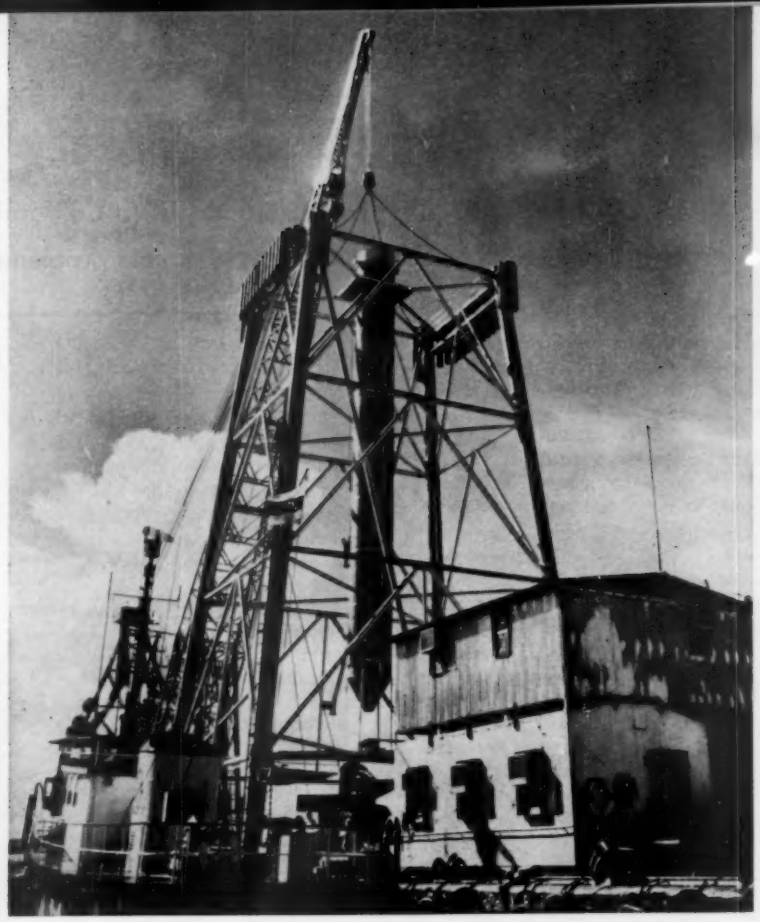
TWO OIL-COMPANY lawyers—Monk Edwards of Gulf Oil Corp., Pittsburgh, and Frank Bolton of Socony Mobil Oil Co., New York—explain to newsmen defense plans for the price-fixing conspiracy trial opening in Tulsa February 1. The charges are being pressed by the antitrust division of the Justice Department and will be heard in U. S. District Court by Judge Royce Savage. Teams of oil-company lawyers spent last week in Tulsa completing defense strategy and making last-minute filings both for companies as individuals and for the industry in general. The trial is expected to last from 2 to 4 months (OGJ, Jan. 25, p. 117).

New Idea Put to Work

AN ALUMINUM open-bottom surge tank is now part of Venezuela Sun's automatic production station in Lake Maracaibo. The tank will handle 100,000 bbl. daily.

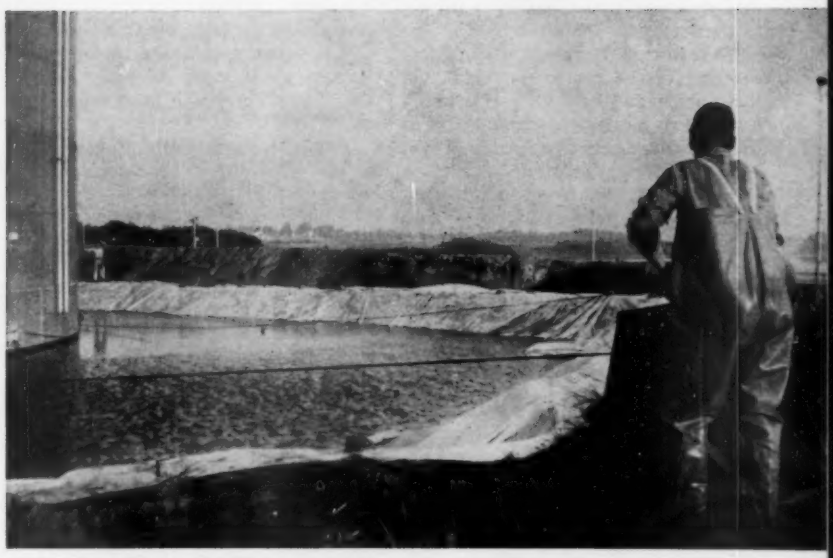
The surge tank is almost completely submerged in water, and its conical bottom is open to the lake. The water supports the weight of the crude above and reduces the dead weight of the equipment, thus cutting the over-all load on the platform. The tank is 91 ft. long and is supported by a four-legged aluminum platform which is anchored with steel pilings.

The tank, designed by J. Ray McDermott & Co. with an assist from Reynolds Metals, is another example of the wider use of aluminum in the highly-corrosive lake.



Ready to Fight Smog

BARBARA BINGHAM, a secretary at Universal Oil Products, displays a new combination muffler-afterburner developed by the company. UOP calls the device Purzaust and claims it can control exhaust emissions throughout a year's operation to meet the standards set by California health authorities. UOP estimates it can make Purzaust available in large quantities at a price of not over $50 the cost of a conventional muffler.



Tank Floats Over Sand

TIDEWATER Oil Co. engineers moved a 150-ton, 35,000-bbl. tank 85 ft. over sandy terrain in 15 minutes by floating it in a pool of water. Workmen at Tidewater's South Portland, Me., terminal prepared a new supporting grade for the tank, built a pool connecting the new and old tank sites, lined it with polyethylene, flooded the area, and then floated the tank into new position. Dikes then were breached and the water disappeared in the sandy soil in 6 hours. A new, larger tank then was built on the old site.

FPC Staff Suggests Gas Treaty With Canada

• Proposal to move Canadian gas to California points up need for agreement with Canadian officials to handle problems of regulation, staff tells FPC.

AN INTERNATIONAL treaty, or some similar basis for regulating natural-gas movements across the Canadian border into the U. S. is being proposed by the FPC staff.

The staff is of the opinion that such an approach would be the most effective way of controlling international sales of gas in the future.

It suggests the establishment of a joint commission to develop mutually acceptable standards on such matters as rates, gas supply, and maintenance of accounts on a uniform basis.

The staff made its proposals in a brief on the proposed project involving the sale of Canadian gas in northern California. Pacific Gas Transmission Co. would purchase the gas at the Canadian border and transport it to the Oregon-California border for resale to Pacific Gas & Electric Co.

The staff favors the project, with certain conditions, but points out that no framework now exists for meeting future problems which may crop up.

Problems ahead . . . The staff anticipates a rise in the gas costs in Alberta due to competition among pipelines in that area for supply.

This, in turn, certainly would affect the cost of the gas to the U. S. On the other hand, the staff says it would not be feasible for the commission to fix a firm, long-term price at the border because this would not allow for the future escalation in the price paid Canadian producers.

The staff points out that the National Energy Board of Canada, which has jurisdiction over interprovincial and foreign export licenses, does not exercise any conventional type of public-utility control over such sales as those involved in the Alberta-to-California project. Furthermore, the board does not continue surveillance over the charges of these companies once a license is issued.

Actually, the National Energy Board will not even specify the initial price. Rather, it will either accept or reject the export proposal as a "package deal."

What the staff wants, therefore, is a joint Canadian-U. S. system under which future prices of natural gas, as well as natural-gas supplies, could be controlled on a continuing basis.

Some members of the commission, including Commissioner William R. Connole in particular, have felt for some time that some such international arrangement would have to be worked out eventually.

Otherwise, they fear, unilateral action could be taken on either side of the border which would have an effect across the border. For instance, prices might be increased or decreased, or the supply situation changed, and the affected country would not be able to do anything about it.

No real problem has thus far developed, but proponents of a joint action feel that establishment of a plan would be good protection against such problems.

And they feel an international agreement could be worked out better now than at some time in the future after disputes and tensions have cropped up.

Staff Picks Canadian Over U. S. Proposal

SOME BRISK border skirmishes may develop between U. S. and Canadian natural-gas companies.

One is already under way, and at this point it appears that a Canadian company may win the right to serve a U. S. area with natural gas.

Last week, the Federal Power Commission staff endorsed a proposal by St. Lawrence Gas Co., a subsidiary of Consumers Gas Co. of Toronto, to supply Canadian gas to the Ogdensburg, N. Y., area.

The FPC staff termed the St. Lawrence proposal "superior" to proposals of Niagara Mohawk Power Corp., a U. S. firm, to serve the same area with U. S. gas.

The staff noted that St. Lawrence could obtain an adequate supply of Canadian gas by building an 8-mile line to tap into Trans Canada pipeline. It said, too, that St. Lawrence's rates would be 15% lower than those proposed by Niagara Mohawk.

If the St. Lawrence proposal is approved by FPC, it would likely encourage further attempts by Canadian companies to supply gas to U. S. consumers.

Old Coal Mine Stores Gas

A SUPPLY of natural gas is stored in an old abandoned coal mine near Denver in case a cold weather emergency should overtax regular available consumer supplies. If necessary, Public Service Co. of Colorado can withdraw up to 15 million cubic feet of gas daily from the Leyden coal mine seven miles northwest of suburban Arvada.

Indications are that conversion of the old mine into storage for more than 3 billion cubic feet of natural gas is successful. The unique project began in March 1958, and testing thus far has been satisfactory.

A compressor station completed recently at the mine has made possible the withdrawal of 15 million cubic feet per day. Three large compressors can feed the gas into temporary lines for Denver metropolitan area consumers served by Public Service.

Gas was injected into Well No. 3 of the old section of the mine. Indications are that the well is gas-tight. A newer section of the mine, known as Well No. 4, 50 ft. below the older section, has been completed and the gas line to it installed. The new well will be used to vent out dead air and other gases as natural gas is forced into the cavern. It has a capacity of 150 million cubic feet.

Public Service engineers say 3 billion cubic feet of natural gas can be stored there under pressure of 300 psi. Complete testing will require several more months before the mine can be filled to capacity.

Cost of developing the mine completely for storage is estimated at $5,217,000. Additional testing will cost about $352,000 more.

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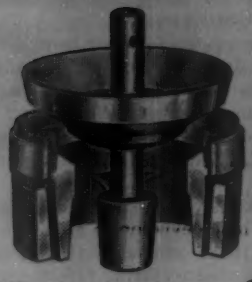

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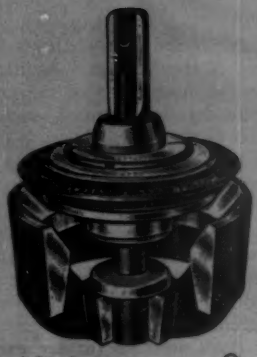

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New Drilling Ideas Are Being Tested

• Byron Jackson is developing a tool to give constant surface readings of hole deviation, and Schlumberger is testing two different machines which will loosen stuck drill pipe.

NEW DRILLING tools now under test in the field may soon take some of the starch out of the contractor's most dreaded enemies—crooked holes and fishing jobs.

One of the tools would satisfy a driller's long-standing yearning for an instrument which would give him a hole-deviation reading at the surface any time he desires. Another would free stuck drill pipe, well casing, tubing, or packers by vibrating the offending assembly.

Both units so far are experimental and not available for commercial use. The continuous deviation-reading device, however, likely will hit the market on a rental basis this year.

Field tests of two different models of the vibrating fishing tool will continue on an accelerated basis. And its makers expect these further tests to decide whether the device has a future as a working tool.

The deviation tool . . . Development of the new tool to provide a continuous check at the surface of hole deviation was disclosed by Simon Tamny, Byron Jackson Tools, Inc., Los Angeles, at a late January meeting of the crooked-hole subcommittee of The American Association of Oilwell Drilling Contractors.

Details on operation are being withheld for the present. But it is known that deviation readings are taken by an instrument assembly contained in a sub just above the bit and are communicated to the surface via pressure impulses in the mud stream.

The instrument, Tamny said, can measure hole-deviation to a maximum drift of 10½° off vertical. Data can be transmitted to the surface through a range of seven pressure pulses—each pulse representing a certain degree of deviation.

The seven pulses can be set so as to show any desired seven deviations up to the 10½° limit. They do not have to be in equal increments and can be set to measure as small as .02° change in deviation.

If a contractor were limited by his contract to a maximum deviation of 5°, for instance, he might want the device set to record deviations of 2°, 3°, 3½°, 4°, 4½°, and 4¾°. This could be done.

Use of the device does entail shutting down the pumps to take a reading. But total down time, Tamny said, runs only about 45-60 seconds. When the pumps are started again, the instrument locks in position, and the pulses are sent to the surface.

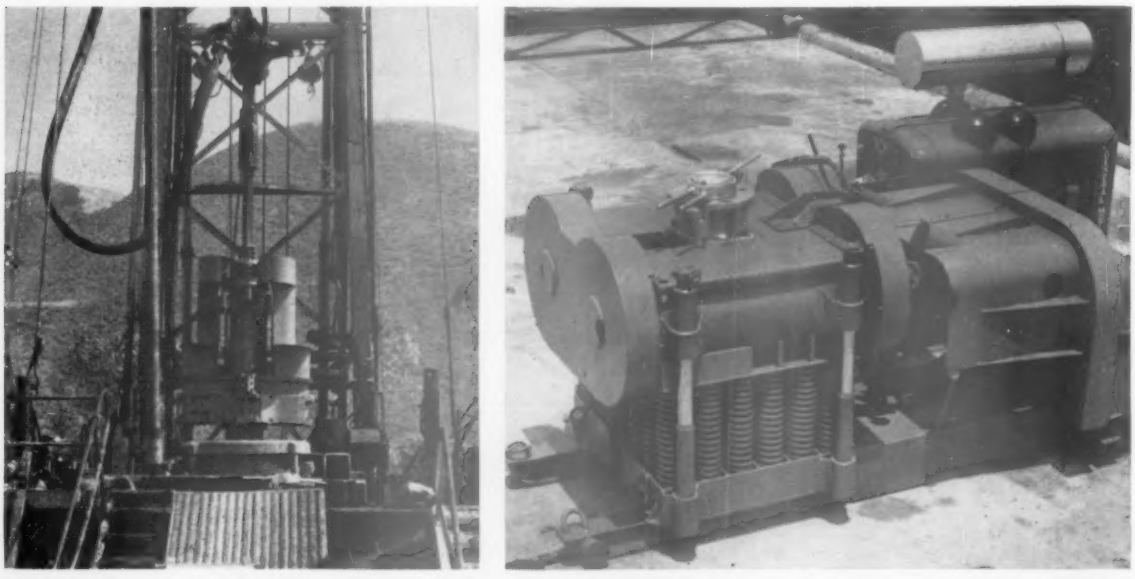
A device at the surface will give the deviation reading on a card. But the pulses can be easily counted by the driller on the mud-pressure gage, he said.

Tests so far indicate that the tool will have a long working life and that its signals are reliable. Such tests have been run so far to depths just under 12,000 ft., Tamny said.

The prime advantage of such a tool would be that it would enable a contractor to keep heavy weight on the bit and make hole faster without the worrisome possibility that the hole might be turning at an angle.

It would have the added advantage of permitting him to check on deviation in formations where he didn't dare do so before by conventional methods because of the danger of shutting down the mud system for a prolonged period.

Byron Jackson estimates the use of the new tool will save the contractor half an hour in rig time each time a



TWO WAYS to free stuck drill pipe and casing are being tested by Schlumberger. One machine, left, is called a torsional tool and the other, right, a vertical tool. Both use off-center weights which rotate around pipe in the well in an effort to vibrate the pipe loose. In addition, the torsional tool uses torsional strain by turning the pipe with the rotary table.

deviation reading is taken. This alone, it feels, would pay out the cost of its use.

The company has not yet reached the point where it has set rental costs to the contractor for use of the device. Indications now are, however, that about $500 a month might be in the ballpark.

Basically, what Byron Jackson has developed is a means of transmitting down-hole information to the surface. It could be used to communicate down-hole data other than hole deviation—for instance, degree of bit wear, clearance of bearings, gage of cones, etc. But this, Tamny said, probably isn't marketable.

The pipe loosener . . . The new tools designed to free stuck drill pipe are undergoing further field tests by Schlumberger Well Surveying Corp.

The company currently is seeking cooperation of contractors in acquiring places for such tests of two different models which vibrate the pipe to free it.

Schlumberger terms one of them a "vertical" tool, the other a "torsional" model.

Both have been used with varying degrees of success, ranging so far from complete success to failure. Both, however, have been revamped to eliminate some early troubles.

Both employ off-center weights which rotate around the pipe in a well to impart a vibratory motion to the pipe. Resonance between the pipe and the slips at the surface occurs when the rotating weights reach a proper speed. This causes a rapid vertical vibration of the pipe. The maximum stress from this vibration is exerted at the point where the pipe is stuck.

The torsional machine combines this vertical stress with a torsional strain by turning the pipe with the rotary table.

Schlumberger's M. LeBourg, of the company's research staff at Houston said the vertical machine had been used successfully to free stuck drill pipe, cemented casing, and sanded-up tubing.

This machine is skid-mounted and weighs about 14,000 lb. It is driven by a 200 hp., 6,000 lb. diesel engine. It operates at a frequency of about 600 cycles per minute. And it has a maximum load capacity of about 200,000 lb. This restricts the unit's operations to depths of 10,000 ft. or less.

The torsional tool so far has not been exposed to as much field testing. It is lighter—weighing about 8,500 lb. And it operates at a higher frequency—about 2,500 cycles per minute.

It has several advantages over the vertical unit. One is that it is not restricted as to depth. Also, it can be operated under pump pressure and with the pipe under tension.

First tests of the torsional model were made in cooperation with Shell Oil Co. at the latter's 440-ft. Test Well X-1 near Ventura, Calif. In this test, a spear was anchored at the bottom of the hole in 13⅜-in., 48-lb. casing. Using 5½-in. drill pipe and a strain against the spear of about 110,000 lb., the spear was shaken free.

Military Stepping Up Oil Take

THE MILITARY will take a little more petroleum during the upcoming 1961 fiscal year, starting July 1, than in the current fiscal year. But both years are below the military totals for fiscal 1959.

Deliveries of major petroleum products from both domestic and foreign sources to U. S. military agencies totaled 736,000 bbl. daily in fiscal 1959, compared with a programmed 697,000 bbl. daily in fiscal 1960 and plans for 705,000 bbl. daily in fiscal 1961.

This is shown in the first of a series of quarterly reports to be made by the Interior Department's Office of Oil and Gas on military liftings of petroleum products.

The 1961 fiscal year requirements include the following (in barrels daily):

. . . Aviation gasoline, grade 115/145, 82,000; grade 100/130, 20,000; other grades, 4,000.

. . . Jet fuel, JP-5, 14,000; other jet fuel, 340,000.

. . . Motor gasoline, 44,000.

. . . Diesel fuel, 52,000; other distillate fuel oil, 14,000; navy special fuel oil, 97,000; and other residual fuel oil, 38,000.

PROCESSING BRIEFS . . .

Olin Mathieson Chemical Corp. will put a new ethylene oxide plant on stream late in 1960 at its Doe Run works at Brandenburg, Ky. The plant is being engineered and built by Lummus Co. and will use ethylene from a neighboring plant for feed stock.

Sunland Refining Corp. has placed on stream a 400-bbl.-daily Universal Oil Products Co. Merox unit at its Bakersfield, Calif., plant for treating thermally-cracked gasoline. The process permits continuous mercaptan extraction with caustic regeneration followed by continuous solid bed Merox sweetening.

British American is expanding its Calgary refinery crude capacity from 7,500 to 10,000 bbl. daily. The construction program, to be completed next fall, includes enlargement and revamping of existing combination, crude topping, vacuum, and thermal cracking units. About 100 men will be hired at peak construction periods.

A new gas processing plant in the Consort area of Alberta has been placed on stream by Canadian Chieftain Petroleums. It has capacity of 10 million cubic feet daily. Initial deliveries have been made to Trans-Canada Pipe Lines. Canadian Chieftain has a 70% interest and Consolidated Mic Mac Oils and Mayfair Oil & Gas each have 15% interest.

Allied Chemical Co. is now ready to manufacture polyethylene glycol at its new facilities at Orange, Tex. This product is used to make emulsifying, dispersing, plasticizing, and lubricating agents.

Also for Refiners . . .

IN THE NEWS: Roosevelt has introduced four bills in the House affecting marketing. One would provide outright divorcement of marketing from integrated oil companies (p. 59) . . . A new tool, a solid state ionization chamber, will help oil men detect and measure nuclear radiation more quickly (p. 76) . . . Free-world crude production sets new record (p. 83).

PLUS THESE TECHNICAL REPORTS: How Richfield reduced cat cracker feed contamination (p. 86) . . . Survey of petrochemical and field-processing plant construction (p. 111) . . . Semiautomation of deethanizer improves gasoline-plant operation (p. 125).

FPC, IPAA to Seek Clarification of Gas Laws

• There's no promise of support from either Congress or the White House, but this won't keep the FPC and some industry leaders from trying.

TWO APPEALS for natural-gas legislation to ease and clarify the regulation of natural-gas producers were made last week.

The Federal Power Commission, in its annual report, proposed a variety of changes. For the most part, these were similar to recommendations the agency has made to Congress in previous years.

The executive committee of the Independent Petroleum Association of America announced after a 2-day meeting in Washington that it would press for gas legislation this year.

Neither the recommendations by the FPC nor the IPAA appear to be the action needed to trigger a strong drive for congressional action.

At this point, neither Congress nor the administration appears to be willing to take the lead.

No promises yet . . . The IPAA officials may have been given some reason to hope that this stalemate will be broken.

However, if they received any such assurances during their stay in Washington, they did not say so publicly.

What they did say publicly is that they are going to press for a bill this year.

It is possible that the IPAA feels there is nothing to lose by making the effort now because something might happen to make chances of passage more favorable.

There is nothing, either, in the FPC proposals to indicate that the FPC has been given reason to expect any strong push by the administration or Congress. As a matter of fact, some members have been known to indicate privately that they doubt that gas legislation has much chance this year.

However, the IPAA and the FPC actions could add momentum to a drive should one develop.

FPC proposals . . . The FPC noted in its annual report that a record number of producer filings had piled up during 1959 on the "already huge backlog of proceedings which clogged the commission's dockets."

The commission said frankly that it was continuing to move "with deliberate caution" in drafting and applying regulatory principles to be applied to independent producers.

The legislative proposals made by the FPC last week include:

. . . **Elimination** of any requirement for certificates of public convenience and necessity for producers of natural gas.

. . . **Establishment** of a standard for pricing gas as a commodity without requiring the use of a rate base or utility-type regulation.

However, the commission would be expected to weigh the interests of the consumer in low prices against the necessity of providing assurance of future gas supplies.

. . . **Elimination** of any mandatory requirement for determining and considering costs of or revenues from other products obtained in conjunction with the production of natural gas.

. . . **Spelling out** the authority of the commission to fix producer rates on an area basis. (The commission has been giving strong consideration to this type of approach and apparently would like to have greater protection against any legal challenge of such a move.)

. . . **Elimination** of escalator and "favored nation" clauses in sales by independent producers to transmission lines.

These changes apply to independent producer regulation.

In addition, the FPC has recommended several other changes affecting other aspects of regulation. These would provide:

That a rate change could be sought by a company even though the purchaser had not agreed to the change. Such a step would strengthen court decisions on this point.

That the commission would have full authority to suspend rate schedules covering sales by pipeline companies for resale for industrial use only. Thus such industrial sales would fall under FPC control.

That the commission would have express authority to increase pipeline rates "where necessary to correct undue discrimination," and that the FPC could allocate gas among customers of a pipeline company in periods of shortage.

That the FPC be authorized to prescribe safety regulations covering construction and operation of interstate gas pipelines.

That the commission be permitted to refuse to admit an intervenor in a case if it felt his interests were adequately represented by another party.

That a new provision be enacted to permit the FPC to require interstate pipelines to interconnect with others and to sell or trade gas with such pipelines. FPC would specify the terms for such interconnections and trades.

That voluntary interconnections be permitted on a permanent basis for emergency use.

That the commission be given broad investigatory powers with respect to the gas industry similar to those now conferred on it for the electric industry.

The commission also has proposed that it be authorized to delegate to one or more commissioners or subordinates any portion of functions now requiring commission action.

This, again, appears to be an effort to speed up the work.

New Detector Spots Radiation Danger

OIL COMPANIES, the major users of radioisotopes, will soon have a new tool that will detect and measure nuclear radiation more quickly, accurately, and cheaply than available instruments.

The new tool, a "solid state ionization chamber," was developed by Hughes Aircraft Co. It is essentially a piece of doped silicon so thin that it is barely discernible to the naked eye.

When the new detector is struck by a charged nuclear particle, it emits an electrical pulse which can be both measured and analyzed.

Thus it makes it possible to detect the kind of radiation, its intensity, and the amount of energy it possesses almost instantly. Cost of the device alone, when it is produced in volume, is expected to be well under $10.

Many industrial applications are foreseen for the new detector. Since the device speeds up and simplifies detection and greatly reduces its cost, it is expected to become a highly important quality control instrument.

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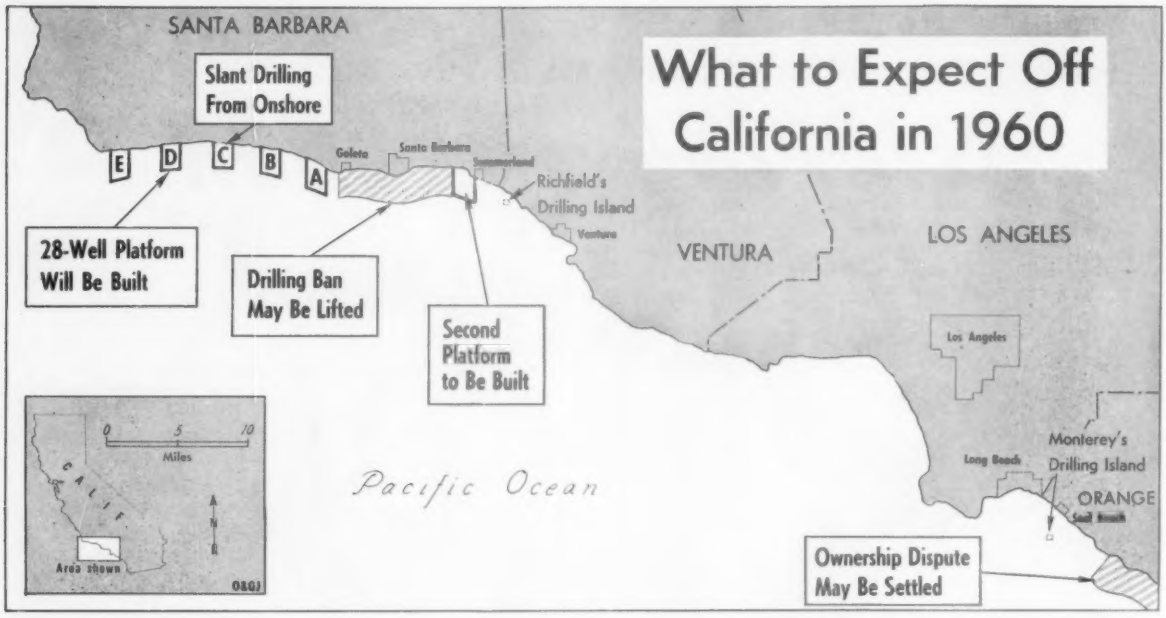


Quiet Year Expected Off California

- A high-priced tract off Santa Barbara County will be drilled and a second platform will go up off Summerland, but no big jump in drilling is expected.
- There is a slight chance new acreage off the city of Santa Barbara or off Orange County may be put up for leasing.

A GROUP of offshore California operators will find out this year if they were justified in paying an all-time high bonus for an offshore lease.

The group, Texaco Inc., Monterey Oil Co., and Newmont Oil Co., will start drilling on Parcel D off Santa Barbara County. The group paid $23,711,538 for the 3,840-acre lease 18 months ago (OGJ, July 7, 1958, p. 72), The per-acre price of $6,175 tops any price ever paid for an offshore lease either off California or in the Gulf Coast.

The Parcel D drilling will probably be the biggest news off California this year, but there's a chance some more acreage may be put up for leasing.

Santa Barbara city fathers are making noises which indicate they want to open up their "oil sanctuary" for drilling after years of opposition. And there is a possibility—but a slim one—that the long ownership dispute over tidelands off Orange County may be settled.

One other big drilling program is planned for the year. Standard Oil Co. of California plans to build a second platform on its Summerland lease. Any other drilling off California this year will be confined to a small amount of core drilling and development drilling from existing platforms and artificial islands.

Parcel D plans . . . Texaco, as operator on the Parcel D lease, will build a two-deck, 28-well platform on the lease. The platform will be built in about 85 ft. of water and approximately 1½ miles offshore.

Texaco is not going into the drilling program blindly. One core hole drilled to evaluate the lease reported flowed at the rate of 1,393 bbl. daily. The crude was 35° gravity.

Second look . . . Santa Barbara city officials long have fought to protect the tidelands off the city. They went so far as to annex the area in 1957 to maintain the drilling ban (OGJ, June 10, 1957, p. 76).

Now officials are worried that drilling on the parcels north of Santa Barbara and Standard of California's Summerland might be draining oil from the city's tidelands.

In addition to the threat of drainage, another factor is playing a role in possibly changing Santa Barbara's mind about drilling. It is Redondo Beach's experience of the past couple years.

Redondo Beach on Santa Monica Bay has been enjoying substantial oil royalties from a model subterranean,

PIPELINE

An 8-in. line connecting Scipio field, near Mosherville, Mich., to the Buckeye Pipe Line terminal near Samaria will be completed this month by Ohio Oil. Contractor on the 60-mile line was O. R. Burden Construction, Tulsa. The new crude line will start taking 5,000 bbl. daily that has been trucked to market.

Contract to build a 33-mile 12-in. crude line for Magnolia Pipe Line in Cameron Parish, Louisiana, has been awarded to Sharman, Allen, Gay & Taylor, Houston. Construction got under way last week.

landscaped oil development conducted by Signal Oil & Gas Co. from a beach front location.

Suit end nearing . . . Another area of considerable interest to prospective offshore oil operators is the 40 miles of tidelands off Orange County. But, this area has been tied up in litigation since 1956.

The trouble began when Orange County, claiming title to the acreage, awarded an exploration and development contract for the whole area to American Marine Exploration Co. headed by Wesley West. A lawsuit developed in which the state claimed a 1919 grant pertained only to Newport Bay while the county claimed it in effect awarded the whole coastline to the county.

Last December, the county suffered a setback when American Marine terminated its disputed contract with the county and withdrew from the suit. Up to that point, American Marine had been picking up the tab for the lengthy and expensive lawsuit. It has been estimated American Marine sunk $3 million in defending Orange County's position.

With American Marine's financial support gone, the county must go it alone. There's considerable doubt whether it will. In any event, the county has another 1½ years to make up its mind before the 5-year statute of limitations on this type of case expires.

Presently, there are more than 600 wells producing from leases offshore from Orange County. These slant-drilled wells have netted the state more than $100 million over the years making the whole area very attractive to oil operators as well as the county and state.

The wells were drilled on leases awarded by the state years prior to the decision of Orange County to start contesting the area's ownership. The county was also asking for an accounting of the millions, as well as a determination of ownership.

There's little likelihood of anything being done to clear up the hassle during 1960.

Most activity . . . The bulk of the state's offshore activity will continue to center around Parcel D, the four other parcels leased along with D, and the 5,500-acre Summerland lease.

With the exception of D, here's a rundown on these leases:

. . . **Parcel A.** Little is known of operations on this parcel held by Phillips Petroleum Co. in association with 40 other firms and individuals. However, at least one 7,355 ft. hole was drilled in 180-ft. of water 1½-miles offshore. It was capped in a manner permitting re-entry. No platform plans have been announced for this 3,840 acre parcel.

. . . **Parcel B.** A 6,670-ft. hole was drilled and abandoned on this parcel by Standard of California, as operator for itself and Humble Oil & Refining Co. This test, drilled in 160 ft. of water 1 mile offshore, failed to turn up anything encouraging. It's interesting to note that this parcel attracted a bid less than 1/10th as large as parcels on each side of it.

. . . **Parcel C.** Standard of California-Humble have drilled three core holes on this parcel, at least one of which encountered "encouraging shows" according to Standard. A fourth test will be slant drilled in 1960 from an onshore site.

. . . **Parcel E.** Phillips et al. have drilled several core holes on this most westerly parcel of the five. No details have been released, but one of the partners recently noted "results to date are in no sense discouraging."

. . . **Summerland.** Standard of California and Humble plan to have a second platform on their lease by July or August.

Plans are to use one rig on the platform although earlier reports and artist's conceptions pictured it with two rigs. It will be able to accommodate 24-wells and will be located in 106 ft. of water about 1¾ miles offshore.

Present production from the existing platform runs around 1,000 bbl. daily from five wells. Three dry holes have also been drilled from it. Wells No. 9 and 10 were drilling ahead from the two-rig setup.

Additional offshore drilling is being done and will continue in development programs on Richfield Oil Corp.'s island off Rincon and Monterey's island off Seal Beach. The balance of the state's offshore oil well drilling is of the slant-drilled variety from onshore sites.

Core drilling from floating barges, a big business in recent years, is expected to continue but at a substantially reduced rate. All companies with core-boat permits recently renewed the permits, but as of the moment, only Standard of California is active in such work.

Standard of California is drilling the last of nine core holes off Malibu just north of Santa Monica Bay. Two core holes were drilled in San Pedro Bay, one in Santa Monica Bay, and four in eastern waters of the Santa Barbara channel.

The State Lands Commission recently changed the rules for offshore core drilling. Previously, operators could drill only to the first competent or correlative stratigraphic formation. Under the new rules, holes may be drilled to a depth and location previously approved by the commission.

BRIEFS . . .

A dual 24-in. crossing of the Colorado River near Needles, Calif., will be installed by Missouri Valley Dredging Co. for Pacific Lighting Gas Supply. The job is scheduled to begin this week.

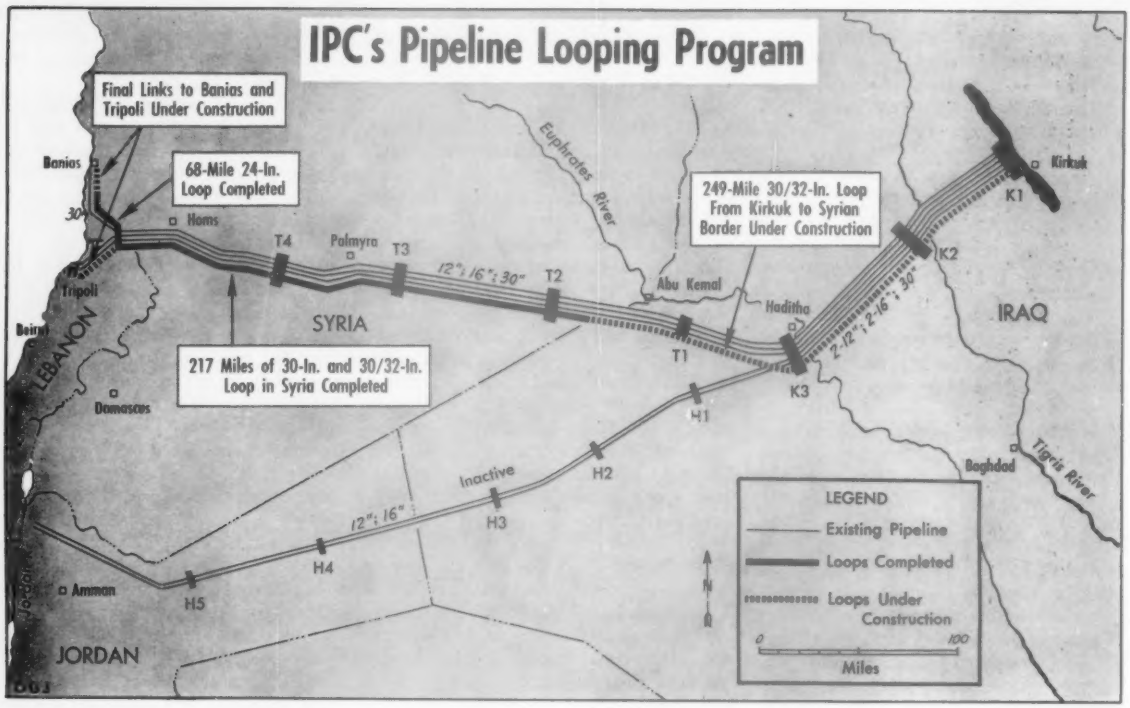
Exports through Canadian oil pipelines in November increased 32.7% above the previous November, reaching 2,776,723 bbl. compared to 2,092,864 bbl. for November 1958. But exports were down 3.4% from the 2,874,792 bbl. recorded in October, according to the Dominion Bureau of Statistics. Total net deliveries for the 11 months ended in November were 279,606,684 bbl., 12.4% above the 248,832,686 bbl. for the corresponding 1958 period.

Colorado Interstate Gas Co., Colorado Springs, is making an estimated refund of $11 million to 14 wholesale customers in five states under a plan approved by the FPC. The refund is the last of $50 million in refunds by Colorado Interstate, representing rate increases to wholesale customers from January 1, 1954 through 1959.

Also for Pipeliners . . .

IN THE NEWS: United Gas Pipe Line offers record price for Bastian Bay gas reserves held by Gulf and Tidewater (p. 61) . . . FPC staff points out need for an agreement with Canada over problems of gas exports (p. 72) . . . Iraq's looping job passes halfway mark (p. 80) . . . French plan line from big Algerian gas field (p. 82).

PLUS THESE TECHNICAL REPORTS: How Panhandle Eastern combated five common cooling-water problems (p. 101) . . . Effect of detergent oils on corrosion (p. 132).



Iraq's Looping Job Passes Halfway Mark

• Pipeline crews are working on other sections which parallel IPC's lines from Kirkuk to Mediterranean. The expansion is aimed at keeping the company competitive with other Middle East producers.

PIPELINE spreads in northern Iraq are starting on the second half of the most elaborate looping program ever planned in the Middle East.

The crews are moving alongside the existing network that runs westward some 550 miles from Kirkuk oil field to terminals on the Mediterranean.

The newest loop is a 249-mile 30/32-in. section from Kirkuk to the Syrian border. It will tie into another series of loops that already extend most of the way across Syria.

Iraq Petroleum Co. awarded the contract to Turriff-Burden, Ltd., London. The firm is an associate of Turriff Construction Co., London, and O. R. Burden Construction Corp., Tulsa.

The actual contract calls for construction of 314 miles of 30/32-in. line. The remaining 65 miles will be laid in southern Iraq, from Zubair field to a new terminal at Fao.

Both projects are part of programs designed by IPC to keep the virtually landlocked country competitive with other big Middle East producers in the world's export markets.

Output up . . . New loops in Syria have already enabled production increases in northern Iraq, the bulk of which is exported via the expanding pipeline system. This volume of output rose to nearly 600,000 bbl. daily last year.

A total of 217 miles of 30 and 30/32-in. line has been laid across Syria in nine separate looping projects. Two 24-in. loops of 28 and 40 miles have been added at the western end of the system. Final links to tanker terminals at Banias, Syria, and Tripoli, Lebanon, are under constructon.

The 65-mile loop in southern Iraq will parallel an existing 24-in. line from Zubair to Fao, on the Persian Gulf.

The expansion programs in northern and southern Iraq are geared to raise the country's export capacity to 1,140,000 bbl. daily by the end of 1961. This will be accomplished by facilities to handle exports of 700,000 bbl. daily from Kirkuk and smaller fields in northern Iraq.

The remaining 440,000 bbl. daily will be available from Rumaila and Zubair fields in southern Iraq. Rumaila will be able to supply 380,000 bbl. daily, and Zubair, 60,000 bbl. daily.

IPC's existing system from its northern fields to the Mediterranean consists of three lines of 12, 16, and 30-in. diameter. Its outlets have always been particularly vulnerable to political troubles in the Middle East. A 16-in. leg to Haifa was nearly completed when the Arab-Israeli war broke out, in 1948, and Iraq never permitted the line to open.

The present system was sabotaged in 1956 during the Suez crisis, and more than a year was needed to restore the system to its full capacity.

The bottleneck in southern Iraq is being removed by a terminal being built 24 miles offshore in the Persian Gulf.

NEW BAROID RHEOMETER TESTS FLOW PROPERTIES

The new BAROID RHEOMETER is a rotational viscometer to field-test the flow properties of drilling fluids. The BAROID RHEOMETER operates at two rotational shear rates. Readings are used to determine the *plastic viscosity* and *yield point* of drilling fluids.

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French Plan Line from Big Algerian Gas Field

SAHARAN natural gas may or may not ever get to European markets, but the French are determined that it will serve the Mediterranean coast of Algeria and help in the industrialization scheme for the country.

The French expect to start construction within the next few months on a 24-in. pipeline to carry the gas north from the big Hassi R'Mel gas field to both Algiers and Oran.

They have already landed 54 miles of the 327 miles of pipe needed at the Algerian port of Mostaganem. They started trucking more than 40 miles of this initial pipe supply south more than 100 miles to Tiaret almost immediately.

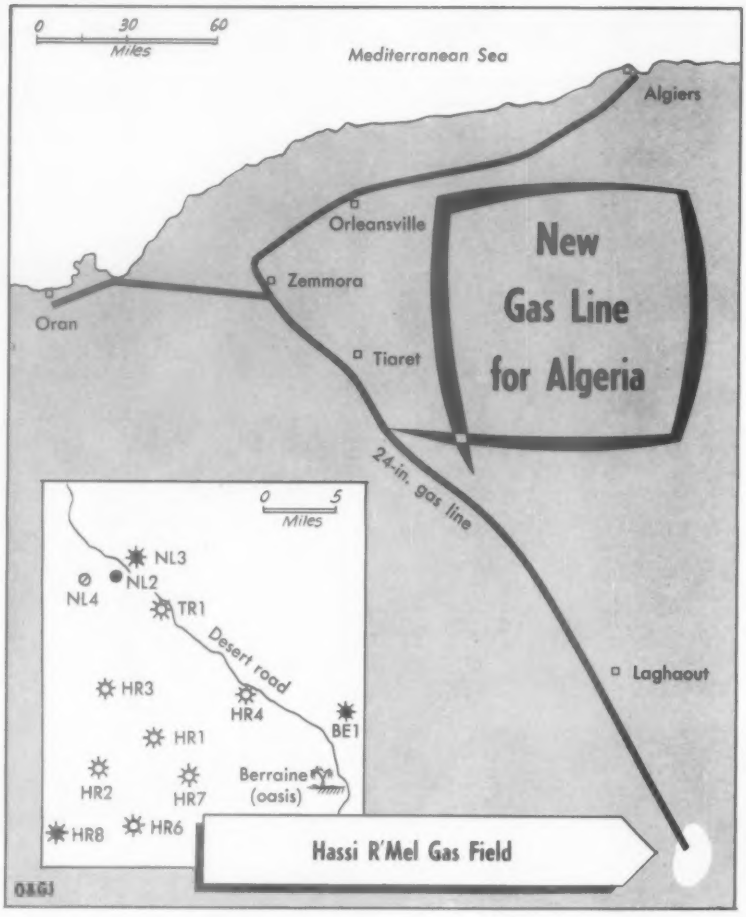
Contract for construction of the first 200 miles, from the field north to Tiaret, was awarded to Groupement Enterpose-Ste. Parisienne pour L'Industrie Electrique (GREP) late last year (OGJ, Dec. 28, p. 89).

There was no official word last week on construction contracts for the additional "legs" of the system northwest to Oran and northeast to Algiers.

The French hope ultimately to be able to ship the vast gas supplies into European markets, but until the technical problems of crossing the Mediterranean are licked, the gas will be used in North Africa. This gas use is a part of President Charles DeGaulle's "Constatine" plan for the industrialization of Algeria.

Jacques Soustelle, the French minister of the Sahara, has said repeatedly in the past that Hassi R'Mel gas will furnish the energy for a booming steel industry at Bone within 5 years. Soustelle envisions using the gas as fuel to convert Ouenza iron ore into steel.

Soustelle has pledged that the Saharan gas will be sold to Algerian industry "roughly at cost." This would easily support his claim that it will be the lowest cost supply in the world.



The field . . . The French are building the big-inch pipeline in spite of the fact that they have suspended drilling for gas at Hassi R'Mel for the present.

The pipeline, they say, will supply 48,000,000 cu. ft. of gas daily from the eight gas wells so far completed in the big field. These wells cover an area at least 50 miles southwest-to-northeast and at least 40 miles wide. The field, by no means defined, has a potential of almost 200,000,000 cu. ft. daily now.

Official French engineering estimates now place the field reserves at 30 trillion cubic feet.

Present efforts of Soc. Nationale des Recherches de Petrole en Algerie (SN Repal), the discoverer of the Hassi R'Mel gas, are concentrated on oil production found to the north. The company has found light crude shows in the gas wells on both flanks of Hassi R'Mel. To the north at Bordj Nili, the company has completed one prolific crude producer.

SN Repal is now trying to evaluate this crude discovery with NL 4, a 3-mile stepout to the west.

The French-government controlled company is secure in the knowledge that further development drilling at Hassi R'Mel could easily keep pace with the need for future gas reserves long before they are needed.

Denver Firm Launches Australian Hunt

DRILLING operations by mid-summer is the target of a Denver independent on a new 23,000,000-acre concession in the Murray River basin of South Australia.

Preliminary geological work is under way and some shallow drilling sites are to be selected by the middle of the summer, says H. A. Hackathorn, president of Hackathorn Oils, Ltd., Denver. Hackathorn has operations in the Rocky Mountain and Mid-Continent areas and has about 40 producing oil wells.

Hackathorn says that two slim-hole rigs will be sent to Australia for the drilling, and that some other independents plan to take part in some of the exploration program. He declined to name the firms.

The concession, 3S, is in the southern portion of South Australia. Hackathorn holds exploration rights on 70 million acres in three Australian concessions. The other two concessions are 5S, also in South Australia, and 3W in Western Australia.

Foreign Output Tops

- Record high reached as Middle East production hits 4.8 million barrels. Venezuela also jumps.

CRUDE PRODUCTION in foreign areas of the free world rose to an all-time high in November.

The record came as output in the Middle East passed 4.8 million barrels daily. This gain was largely the result of a jump in Saudi Arabia to an average of 1,210,300 bbl. daily, which erased a record which stood more than 2 years.

A sizable gain in Venezuela also helped the foreign total. Operators produced more than 2.8 million barrels daily for the first time since March.

Production from Hassi Messaoud field in Algeria doubled to 58,000 bbl. daily as the French operators filled the 24-in. pipeline to the Mediterranean. The new system opened in December.

Output from older fields in northern Algeria has resumed after a lapse of more than a year. But output is less than 100 bbl. daily.

TREND OVER THE LAST YEAR

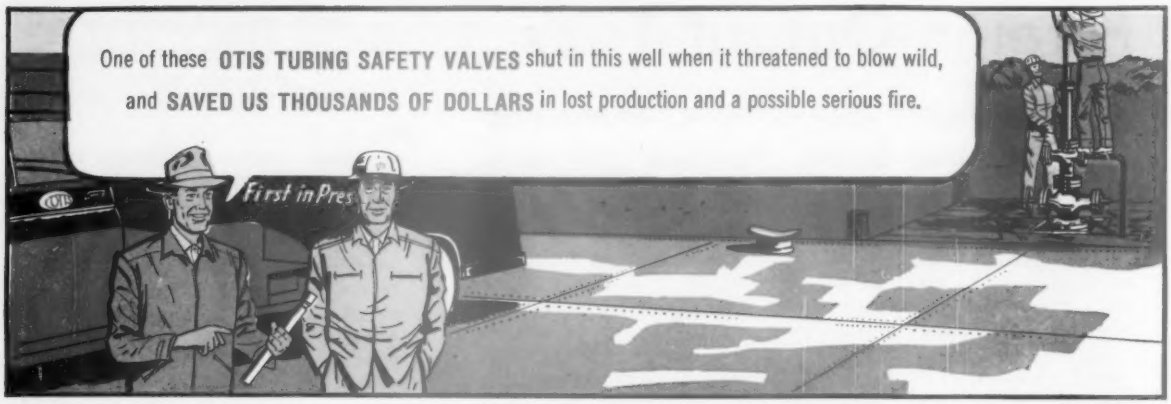
	Western Hemisphere less U.S.	Middle East	Total free-world outside U. S.
1958			
November	4,033.2	4,478.9	9,321.4
December	4,119.9	4,446.2	9,371.4
1959			
January	4,311.6	4,369.3	9,449.5
February	4,453.9	4,426.1	9,649.7
March	4,220.6	4,634.2	9,680.7
April	3,910.4	4,646.4	9,396.5
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,914.8	4,532.5	9,293.2
August	3,862.1	4,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,069.6	4,688.2	9,629.8
November	4,141.3	4,817.8	9,887.2

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Nov. 1959	Oct. 1959	Nov. 1958
Western Hemisphere			
Argentina	125.8	125.8	113.6
Bolivia	8.9	8.9	9.7
Brazil	75.0	75.0	60.7
Canada	498.0	509.0	451.0
Chile	18.6	18.6	15.9
Colombia	144.3	151.3	135.9
Cuba	0.5	0.5	0.7
Ecuador	7.6	7.6	8.2
Mexico	265.0	265.0	262.4
Peru	47.2	47.2	51.6
Trinidad	115.8	114.2	106.8
Venezuela	2,834.6	2,746.5	2,816.7
Total	4,141.3	4,069.6	4,033.2
Europe			
Austria	45.3	45.3	51.9
France	34.7	34.6	27.7
West Germany	104.5	101.5	89.9
Italy	35.8	30.2	22.1
Netherlands	34.1	33.9	33.4
United Kingdom	1.7	1.7	1.8
Yugoslavia	12.0	12.0	8.8
Total	268.1	259.2	235.6
Middle East			
Bahrain	45.2	45.0	45.3
Iran*	995.0	948.0	811.0
Iraq†	907.8	915.8	781.8
Israel	2.0	2.0	2.0
Kuwait	1,370.1	1,411.8	1,504.6
Neutral Zone	118.6	118.6	104.6
Qatar	161.1	173.1	188.6
Saudi Arabia	1,210.3	1,066.2	1,034.2
Turkey	7.7	7.7	6.8
Total	4,817.8	4,688.2	4,478.9

Country—	Nov. 1959	Oct. 1959	Nov. 1958
Other Asia			
British Borneo	110.0	110.0	112.3
Burma	10.5	10.5	10.5
India	8.5	8.5	8.7
Indonesia	360.0	340.0	328.1
Japan	8.5	8.5	7.3
New Guinea	4.5	4.5	5.2
Pakistan	5.9	5.9	6.0
Total	507.9	487.9	478.1
Africa			
Algeria	58.1	29.4	13.0
Angola	0.9	0.9	0.9
Egypt	61.6	64.1	62.3
Gabon	15.3	15.3	11.3
Morocco	2.2	2.2	1.5
Nigeria	14.0	13.0	6.6
Total	152.1	124.9	95.6
Free World			
Foreign	9,887.2	9,629.8	9,321.4
United States	6,982.0	6,911.0	6,984.0
Total	16,869.2	16,540.8	16,305.4
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	235.0
Russia	2,688.0	2,688.0	2,260.0
Others	100.0	100.0	60.0
Total	3,023.0	3,023.0	2,555.0
WORLD TOTAL	**19,892.2**	**19,563.8**	**18,860.4**

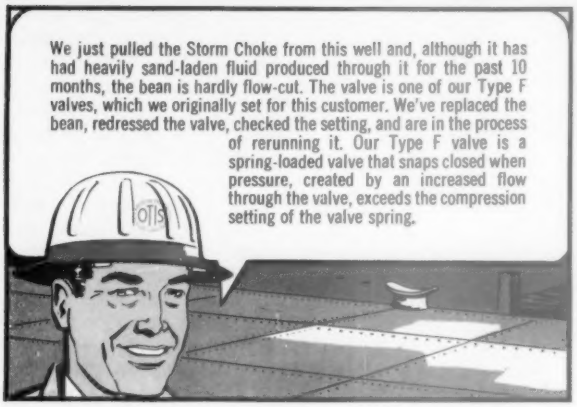
Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,300 bbl. daily from Naft Khaneh field, operated by Iraq Government.

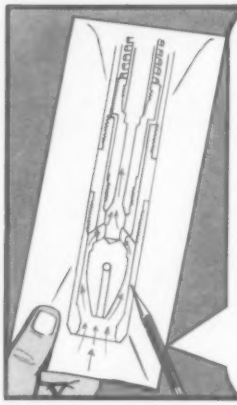

One of these OTIS TUBING SAFETY VALVES shut in this well when it threatened to blow wild, and SAVED US THOUSANDS OF DOLLARS in lost production and a possible serious fire.
First in Pres

The well was producing 2½ M.M.C.F.D. of gas with 89 B.D. of sand-laden oil when a leak developed at the flange of the master valve. At the time, the flowing pressure was 3,100 P.S.I., so it didn't take long for the gas and sand to cut out a sizable hole. As soon as the pressure differential exceeded the setting of the Otis Storm Choke, it automatically snapped shut.

This morning we pumped down through the safety valve and killed the well with water—then broke out the master valve to repair the leaky connection. Now we're resetting the tree. We called out Otis to pull, check, and redress the safety valve before we put the well back on production. The valve's probably O.K., but it's been down there 10 months and under our safety program we pull all of our safety valves periodically for inspection anyway.

We just pulled the Storm Choke from this well and, although it has had heavily sand-laden fluid produced through it for the past 10 months, the bean is hardly flow-cut. The valve is one of our Type F valves, which we originally set for this customer. We've replaced the bean, redressed the valve, checked the setting, and are in the process of rerunning it. Our Type F valve is a spring-loaded valve that snaps closed when pressure, created by an increased flow through the valve, exceeds the compression setting of the valve spring.





In the opened position, flow through the valve follows a single, straight course. The valve is designed so that the sealing surfaces of the valve, and the valve seat, are out of the direct line of flow to minimize possible cutting action of the fluid. Although our tubing safety valves are pressure-differentially-operated, they will not close prematurely due to surging heads—and they can be adjusted to operate dependably within a very close range.

Otis Tubing Safety Valves, or Storm Chokes as they've been called for years, can be run in and landed under pressure in Otis nipples made up in the tubing string, or set in the tubing on slips for wells without nipples. OTIS TUBING SAFETY VALVES, SET BY OTIS CREWS, HAVE NEVER FAILED TO SHUT IN A BLOWOUT. Call the Otis office nearest you and talk to them about installing tubing safety valves—before you need them. A small investment in an Otis Storm Choke today can protect you against a possible fire or wild well tomorrow. PLAY IT SAFE WITH A SAFETY PROGRAM—CALL OTIS!

OTIS—"First in Pressure Control"

OTIS ENGINEERING CORPORATION

General Offices: 6612 Denton Drive · Dallas

Branches Throughout the Oil Country

Refinery in Libya

. . . to be built by Jersey. Pipeline outlet for Zelten field is also planned.

LIBYA'S first refinery will be built by Standard Oil Co. (N.J.).

Esso Sirte, a wholly-owned affiliate, will build a 4,000-bbl. plant at a site still to be determined. Its capacity will be about double the country's existing demand.

The project is part of an over-all deal in which Esso Sirte acquired half interest in three concessions held by Libyan American Oil Co. and W. R. Grace & Co. The affiliate agreed to build the refinery as one of the terms set down by the government before the purchase into the concessions would receive official sanction.

Esso Sirte is half owner and operator on Blocks 16, 17, and 20 in Cyrenaica and Tripolitania. The remaining half interest continues to be shared by Libyan American, a Texas Gulf Producing Co. subsidiary, with 25.5%, and W. R. Grace, with 24.5%. Two wells capable of a total of 2,000 bbl. daily have been completed on Block 17, and a third is testing (OGJ, Jan. 18, p. 61).

The original Jersey company, Esso Libya, has ordered 100 miles of 30-in. pipe for an outlet from its Zelten field to the Mediterranean coast. The pipeline route and terminal location have not yet been established.

Abu Dhabi Test Drills Ahead

A THIRD wildcat is drilling ahead on a teasing structure in Abu Dhabi, a shaikhdom in southern Arabia.

Murban 3 is drilling ahead at 2,883 ft. at a location 7 miles west of Murban 2. The second well was abandoned at 10,585 ft. last year after tests. Initial reports were the well flowed 2,000 bbl. daily from two zones (OGJ, July 20, p. 61).

Petroleum Development (Trucial Coast), Ltd., an affiliate of Iraq Petroleum Co., has been drilling intermittently on the Murban structure for more than 6 years. The first well came in at 1,500 bbl. daily, but the well failed to flow when retested after mechanical trouble.

The structure lies comparatively close to the Persian Gulf, and is about 150 miles southeast of Qatar Peninsula.

The company's concessions in the area have been reduced with the surrender of rights over the mainland of Sharja, and expiration of rights in Fujaira.

Aussie Refinery to Expand

A $50-million expansion at Royal Dutch-Shell's refinery at Clyde, Australia, will center around a new cat cracker.

The $38-million unit will handle 150 Imperial gallons yearly, or about 11,750 bbl. daily. Work will start early this year and will take 3 years to complete.

The cracker will enable the 20,000-bbl. refinery to use a greater variety of feed stocks from the world's oil fields. The unit also will provide a supplementary feed stock for a new $22-million ethylene unit being built jointly by Shell and Imperial Chemical Industries of Australia and New Zealand.

New port facilities will be built at Gore Bay, New South Wales, as part of the program. A 12-mile crude pipeline also will be built from Gore Bay to the refinery.

German Price War

. . . hurting major refiners. No end seen to price cuts.

THE TIME-HONORED American custom of gasoline price wars has invaded the German market and promises to increase the losses already traditional in that country for the world's major oil companies.

It is estimated that the 2-cent to 4-cent per gallon price cuts made by brand marketers in Germany during the past 2 weeks will cost the industry more than $40 million this year, if the price cuts stay. There is every indication that competitive pressures will keep the prices down.

This is the prospect facing companies like Esso, A.G., which reported a loss of more than $4 million last year. Most of the other major refiners and marketers reported similar losses of nearly $3 million each.

The increasing power of the independent marketer in Germany is responsible for the latest assault on profits. Independents, ranging from elaborate service stations to the one-pump outlet, now account for slightly less than 10% of Germany's 28,000 retail outlets.

But, these independents sold at least 12% of Germany's more than 110,000 bbl. daily gasoline demand last year, usually at a price 4 cents a gallon below branded gasoline at the major's pump.

The independents are supplied partially by imports, but their primary sources of gasoline are the major refiners. The majors now find themselves in an uncomfortable spot, grateful for the independents as good customers for their own gasoline surpluses, but being pushed in the market place by the same good customer.

FOREIGN BRIEFS . . .

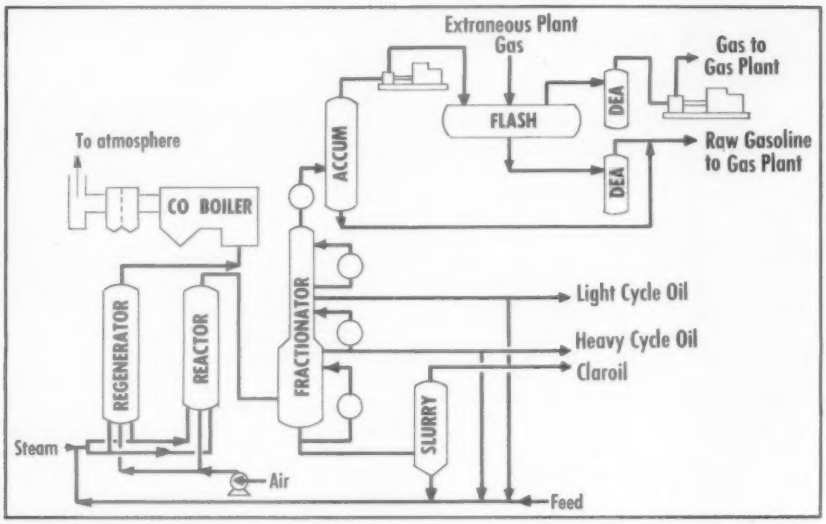
The French last week were waiting for details of a reported oil discovery 20 miles east of Dakar, in Senegal, French West Africa. The well is located in the Sebikotane region, on a license held exclusively by a French company, SAP.

Russia will ship 49,300 bbl. daily of crude and 12,300 bbl. daily of fuel oil to Italy this year under the terms of a new trade agreement. The shipments will represent a 25% increase over last year.

A West German company, Gewerkschaft Elwerath, has taken a 20% interest in a 1,740-sq.-mile license at Tan Emellel, south of the Edjele area in the French Sahara. Its partners are Eurafrep, the operator, with 70%, and a government company, Petropar, with 10%. Elwerath will hold 42.5% in a permit at Hassi Ali, for which the group has applied.

A new company, Istanbul Petrol Rafinerisi, A. S., (IPRAS), is being set up to own and operate a new refinery to be built by Caltex and a government company, Turkiye Petroleri, A. O. (TPAO). The main construction contract for the 20,800-bbl. refinery has been awarded to M. W. Kellogg. The $25,650,000 plant will be erected at a site on the deepwater port of Izmit, near Istanbul. Downstream processing facilities will include a naphtha Unifiner, Platformer, distillate hydrotreater, and fluid catalytic cracker.

Mobil International has acquired a minority interest in a Barbados refining and marketing company. The move gives Mobil an entree to markets on the West Indies Island through part ownership in Barbados Union Oil Co., a local independent, with both service stations and consumer accounts. Barbados Union will handle Mobil automotive and industrial fuels and will modernize and expand a small refinery at Bridgetown to 1,000 bbl. daily.



FLOW DIAGRAM of fluid catalytic cracking unit at Richfield's Watson, Calif., refinery. Fig. 1.

BY E. C. HERTHEL, E. H. REYNOLDS, AND J. H. ROE
Richfield Oil Corp., Wilmington, Calif.

How Richfield reduced cat

BY REDUCING nickel content in feed stock, Richfield Oil Corp. has greatly improved cat cracker operations. While other metal contaminants have an adverse effect on catalyst selectivity, nickel is by far the most serious.

The reduction in metals was accomplished by improved fractionation in the vacuum-distillation unit.

With feed containing 1.0 p.p.m. nickel, Richfield's Watson, Calif., FCC unit was unable to operate at design rates on startup. High hydrogen-gas make limited capacity; high coke make was a contributing factor. Catalyst consumption was also high.

Cracking-unit feed was prepared in a vacuum-distillation unit. The feed was similar to design feed except for the high nickel content.

Improved fractionation of the heavy gas-oil sidestream of the vacuum-distillation unit reduced nickel content in the cracking-unit feed from 1.0 p.p.m. to 100 parts per billion (p.p.b.). Column alterations included more trays and an increased internal reflux.

The vacuum-column changes did not materially change other characteristics of the feed stock. With low nickel-content feed, design rates have been exceeded with fresh-catalyst addition rates of less than 0.2 lb. per bbl. of fresh feed.

Paper presented at the fifty-second annual meeting of the AIChE, San Francisco.

Design detail . . . In mid-1954, Richfield Oil Corp. completed a major expansion of its Watson refinery. The expansion was centered in a 35,000-bbl.-fresh-feed per stream-day FCC unit.

A 60,000-bbl. per day vacuum-distillation unit was built to prepare feed for the FCC unit from 13.9°-API crude residuum.

Fluid Unit Design

The low-silhouette FCC unit was designed to charge 63,000 bbl. of combined feed per stream day. It was designed as a heat-balanced unit to burn 34,000 lb. of coke per hour. Reactor design temperature was 900° F. with a conversion of 55.6% and a catalyst-to-oil ratio of 8.5:1. Catalyst was to be synthetic microspheroidal.

Two stages of gas compression were specified (Fig. 1). The second-stage compressor also handles all other refinery cracked-gas streams. The fluid-unit gas plant processes both streams.

Design of the fluid unit was based on pilot-plant cracking data. Gas oil used in the pilot plant was a 50-50 blend of gas oils produced from long residua from San Joaquin Valley and Los Angeles Basin crudes on an asphalt-plant vacuum column. This gas oil appeared to be desirable FCC unit feed (Table 1). This was confirmed in pilot-plant work.

Vacuum-Unit Design

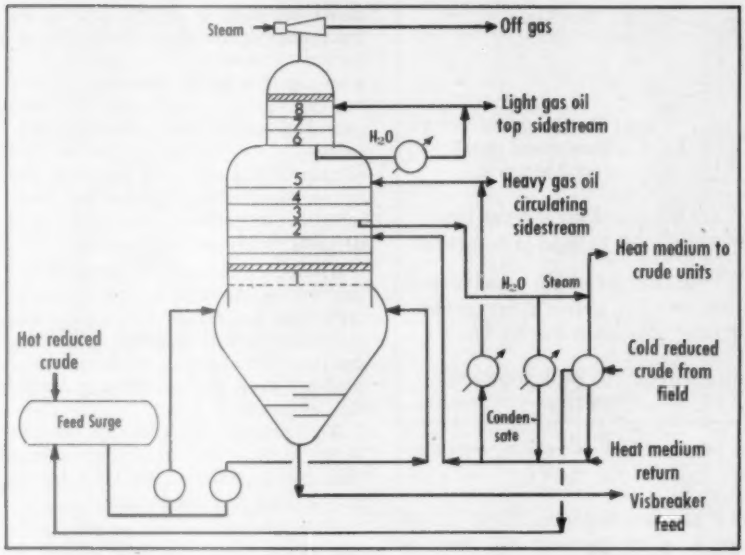
The vacuum-distillation unit was designed to charge 60,480 bbl. per stream day. The unit feed consists of diesel-free residual stocks from all major crude-distillation units in the refinery. Primary sources of this feed are San Joaquin Valley and Los Angeles Basin crudes.

The feed is pumped hot to the vacuum-unit feed surge drum (Fig. 2). Hot feed stock from the surge drum is flow-controlled through two parallel two-coil downfired vertical tube heaters. Each heater is rated at 100 M.M. B.t.u. per hour.

Heater outlet temperatures are controlled to vaporize about 60 to 65% of the total charge.

The mixture from each heater is fed tangentially into the enlarged flash-zone section of the tower on opposite sides (Fig. 3). The feed flows in a descending spiral in an annular section between the tower shell and an internal skirt. Vapor flow reverses from downward to upward 10 ft. below the inlets. The vapors pass upward into the 26-ft.-diameter tower.

Tower pressure is controlled at about 100 mm. Hg absolute in the



REDUCED CRUDE is fed to this vacuum-distillation unit. Fig. 2.

the bottom 26 - ft. - diameter section there were four bubble-cap trays, a wire demister pad, and a bubble-cap tray without caps. The trays and demister pads were spaced at 36-in. intervals. To minimize entrainment to the ejectors a demister pad was placed 4 ft. above the top tray. Four splash decks were installed in the bottom of the tower.

Unit startup . . . Construction of the vacuum-distillation unit was completed in March 1954. The unit was brought on stream to prepare feed stock for the FCC unit scheduled for startup the following July.

During the initial phase of the vacuum-distillation-unit operation, about 1,000,000 bbl. of charge stock was made for the fluid-unit startup. Typical data of the stock are shown in Table 1.

The feed stock was considered satisfactory in all respects. Metals, though appreciably higher than in the feed

cracker feed contamination

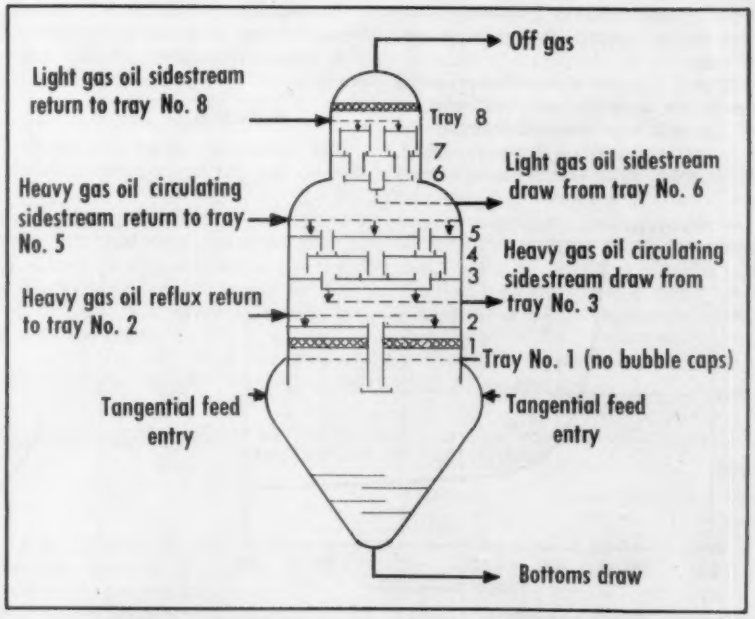
Improved fractionation, increased catalyst-addition rate boost throughput and conversion above design capacity

flash zone with a dual three-stage jet ejector system. Ejectors take suction directly off the top of the column, since it is operated dry with total internal condensing.

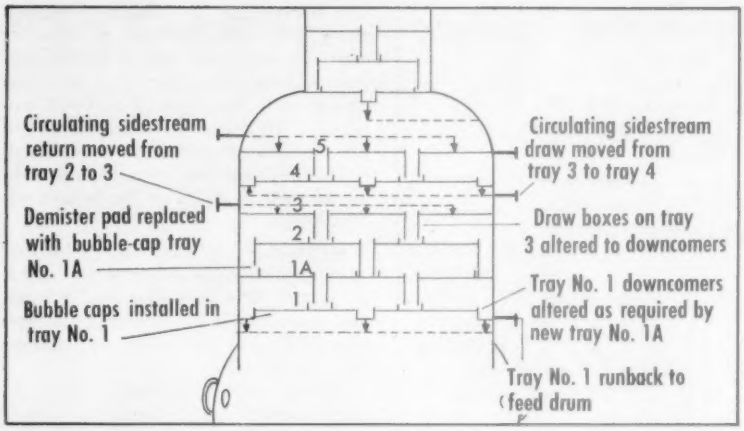
The ejector system uses 550-psig. steam with shell-and-tube interstage condensing. Following the third stage is a single-cylinder steam-driven compressor that boosts the noncondensables to the pressure of the refinery fuel-gas treating system. This complies with local air-pollution control regulations.

The tower separates feed into four streams. Overhead noncondensables flow to the ejectors. Two gas-oil sidestream products, light and heavy, are withdrawn as slipstreams from heat-removing circulating sidestreams. The asphalt bottoms are pumped hot to an adjacent visbreaking unit. The heavy gas-oil circulating sidestreams carry about 110 M.M. B.t.u. per hour to adjacent crude - distillation units where it is used as heat medium.

There are three bubble-cap trays in the top 13-ft.-diameter section. In


Off gas
Light gas oil sidestream return to tray No. 8
Tray 8
7
6
Light gas oil sidestream draw from tray No. 6
Heavy gas oil circulating sidestream return to tray No. 5
5
4
3
Heavy gas oil circulating sidestream draw from tray No. 3
Heavy gas oil reflux return to tray No. 2
2
1
Tray No. 1 (no bubble caps)
Tangential feed entry
Tangential feed entry
Bottoms draw

DETAILED DRAWING of vacuum distillation tower. Fig. 3.


Circulating sidestream return moved from tray 2 to 3
Demister pad replaced with bubble-cap tray No. 1A
Bubble caps installed in tray No. 1
Circulating sidestream draw moved from tray 3 to tray 4
Draw boxes on tray 3 altered to downcomers
Tray No. 1 downcomers altered as required by new tray No. 1A
Tray No. 1 runback to feed drum
5
4
3
2
1A
1

THESE CHANGES in the vacuum distillation tower helped to reduce metals content of cat cracker charge stock. Fig. 4.

stock used in the pilot-plant evaluation studies, caused no apprehension. Mid-Continent commercial FCC units had been successfully operated on charge stocks with total nickel-plus-vanadium contents as high as 2.3 p.p.m. Relative poisoning effects of nickel and vanadium were not considered at the time.

The FCC unit was brought on stream in July 1954. Shortly thereafter it was apparent that something was wrong. Difficulties prevented operation of the unit at design throughput and conditions. They were primarily high coke and hydrogen yields.

The coke limited throughput and conversion due to coke-burning capacity. The hydrogen resulted in a low specific gravity of the gas to the centrifugal compressors which prevented the desired discharge pressures at design capacity. Table 2 shows initial and design compressor operating conditions.

It was concluded that the principal cause for unsatisfactory performance of the unit was contamination of the catalyst with metals from the feed. High coke make was believed in part due to poor stripping. Low reactor-operating temperature was also believed to accentuate the high hydrogen-producing factor.

The adverse effect of heavy-metals contamination on cracking catalyst selectivity had been recognized. Of the heavy metals found in crude oil, nickel, copper, vanadium, and iron appear to have the most serious effect. Data indicate nickel on catalyst to be 5 times as bad, weight for weight, as vanadium and up to 10 times as bad as iron.

Copper has never appeared in quantity in stocks made from California crudes, but is considered comparable with nickel.

Certain basic operation changes to improve fluid-unit operations were made. These included:

1. Reduction of metals in feed.
2. Reduction of metals on catalyst by increasing fresh catalyst makeup.
3. Increase reactor operating temperature.

Reduction of Metals

The laboratory distillation studies showed that the heavy-metals content could be reduced in the gas oil by fractionation, and that increased fractionation below the heavy gas-oil draw was desirable in the commercial unit.

Tray 2, to which only 960 bbl. per day reflux was returned, provided the only fractionation in this section of the tower. A demister pad below the bubble-cap tray had been installed to remove entrained liquid droplets from the vapor stream.

The accepted vacuum-tower design practice, at the time, was to minimize both trays and reflux. Fewer trays and minimum reflux resulted in greater product yield because of lower tower pressure drop and provided construction economies.

To increase fractionation in the lower section, the vacuum tower was shut down in November 1954 for revision. The changes included:

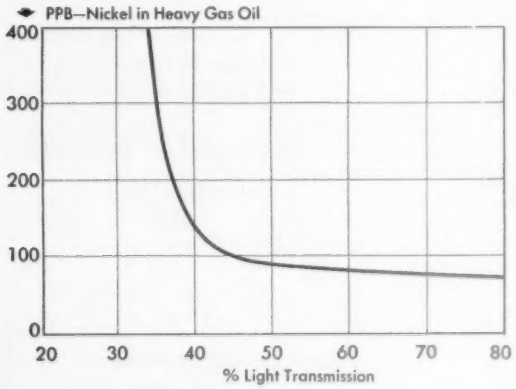
1. Heavy gas-oil sidestream draw was raised from tray 3 to tray 4.
2. Downcomers were installed on tray 3.
3. Tray 2 reflux return was raised to tray 3.
4. Downcomers from tray 2 through the demister pad to tray 1 were installed.
5. Bubble caps were installed on tray 1.

These revisions increased the number of fractionating trays from one to three, without changing the number of trays in the original tower design.

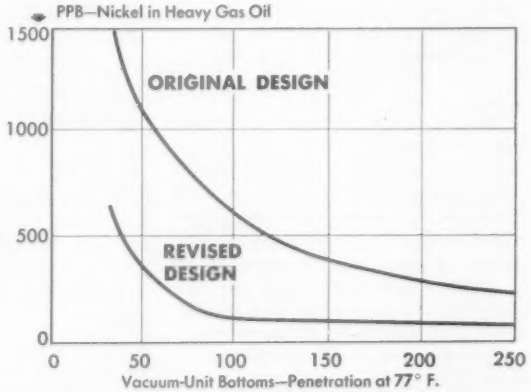
Reflux rate to tray 3 was increased from 960 bbl. per day to 6,000 to 8,000 bbl. per day.

The following year a total draw system from tray 1 was installed to minimize overflash requirements in the heaters. This was a result of quenching in the flash section at the higher reflux rate.

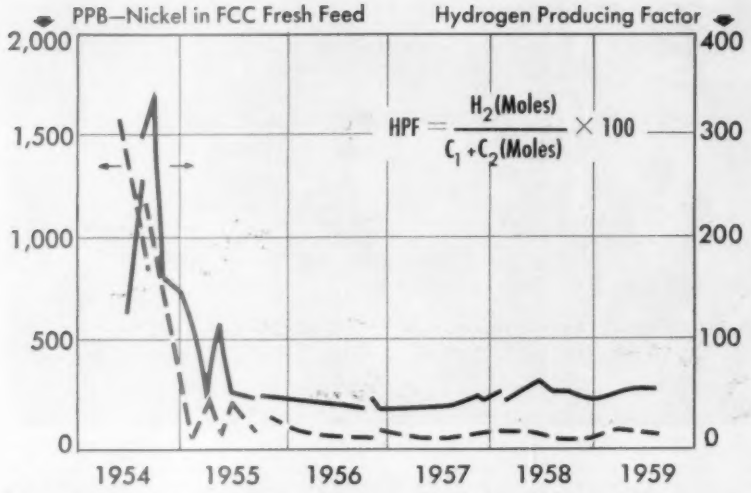
In early 1956 the lower demister pad was removed and replaced with a bubble-cap tray. The pad required repair or replacement due to coking



EMISSION SPECTROGRAPH is used for day-to-day maintenance of product quality. Fig. 5.



CORRELATION of bottoms penetration with product nickel content before and after vacuum tower revisions. Fig. 6.



COMPARISON of fresh feed nickel content with hydrogen-producing factor in the fluid catalytic cracking unit. Fig. 7.

and corrosion at each of the five unit turnarounds to that time. The tray had no measurable effect on product quality, but maintenance expense was considerably reduced (Fig. 4).

At vapor velocities of 3 to 4 ft. per second, heavy gas with nickel content in the range of 100 p.p.b. is presently produced. Before the changes, vapor velocities of this magnitude resulted in heavy gas-oil nickel contents of 500 to 700 p.p.b. With improved tower operation maximum nickel content in the heavy gas-oil product was set for 100 p.p.b. Vanadium and iron average 31 and 1,300 p.p.b. respectively at the 100-p.p.b. nickel level.

To maintain product quality, metals analyses of the heavy gas oil by emission spectrograph are made three times each week. For day-to-day metals control the per cent light transmission in the 6,500-A band (red), as measured on a fresh gas-oil sample, correlated well with nickel content. (Fig. 5).

Other properties such as gravity, distillation, and Conradson carbon are also used as qualitative guides.

There was no significant change in nitrogen content of FCC unit charge with the reduced metals content. However, reduction in metals content has allowed maintenance of higher reactor-bed temperature with higher conversion. Under these conditions nitrogen compounds in the feed are not a problem.

The 1,000,000 bbl. of heavy gas oil with high metals content, produced before the fluid unit startup, was rerun. It was fed to tray 3 as reflux at rates up to 6,000 bbl. per day. This procedure proved satisfactory.

The unit was designed on the basis of a bottoms asphalt penetration of 25 at 77° F. After overhead yield on feed agreed with design, bottoms penetration was used only as a relative criterion of operation. Penetration was higher than design due to visbreaking.

Subsequent to tower alterations, satisfactory heavy gas-oil nickel levels were attained at substantially lower bottoms penetrations. The first 2½ months of operation were lined out at a bottoms penetration of about 110 with a sidestream nickel content in the 100-p.p.b. range.

This was followed by 1½ months of operation at 57 penetration bottoms with a sidestream nickel content averaging 300 p.p.b. Vanadium content was relatively unaffected.

Bottom yield was reduced about 6% at the lower penetration level. Fig. 6 shows the correlation of bottoms penetration with product nickel content before and after tower revisions.

Catalyst Makeup

In November 1954 FCC-unit catalyst-addition rate was sharply increased to reduce the catalyst metals content. This is the same time that reduction in feed-stock metals content was made.

With this feed stock the fluid-unit fresh-charge rate and conversion currently exceed design while catalyst consumption is consistently maintained below 0.2 lb. per bbl. of fresh feed.

The hydrogen-producing factor (100 times the ratio of hydrogen production to total methane, ethylene, and ethane production) also dropped to a satisfactory level with improvement in feed stock and higher reactor temperatures. Fresh-feed nickel content is compared with the hydrogen-producing factor in Fig. 7. Gas gravity approached design level with reduction of the hydrogen-producing factor. Compressor operation has been satisfactory.

Since changes to the vacuum-distillation unit were made, a consistently satisfactory catalytic cracking feed stock has been produced. Properties of typical fluid unit feed are shown in the last column of Table 1.

As quality of the feed stock and equilibrium catalyst improved, increased feed rates were possible. Reactor temperature was raised to 933° F. and conversion was raised to 63.5 vol. %. Coke make at a given conversion level decreased at the higher-temperature reactor operation. Stripping was further mechanically improved by a redesign of the stripping well steam spiders.

TABLE 1—FLUID CATALYTIC CRACKING UNIT FEED-STOCK INSPECTIONS

	Pilot-plant feed	Initial unit feed	Current unit feed
Gravity, °API	22.2	20.7	22.1
Vacuum dist., °F.:			
I.b.p.	441	440	398
5%	560	605	550
10%	618	655	601
50%	751	780	750
90%	880	915	885
Sulfur, wt. %	1.01	1.16	1.05
Aniline point, °F.	152	155	154
Conradson carbon, wt. %	0.12	0.48	0.14
Total nitrogen, wt. %	0.32	0.29	0.34
Metals analysis, p.p.b.:			
Sodium		400	
Nickel	79	1,000	110
Vanadium	34	350	37
Iron		8,600	1,300+
Copper		40	12

TABLE 2—COMPARISON OF INITIAL COMPRESSOR OPERATING CONDITIONS WITH DESIGN SPECIFICATIONS

	First stage		Second stage	
	Actual	Design	Actual	Design
Rate, 1,000 s.c.f. per hour	863	1,226	1,031	1,326
Suction pressure, psia.	18.5	14.7	113	125
Discharge pressure, psia.	128	140	225	430
Gas gravity (air = 1)	1.013	1.372	0.7627	1.058
R.p.m.	7,250	7,150	9,750	10,200

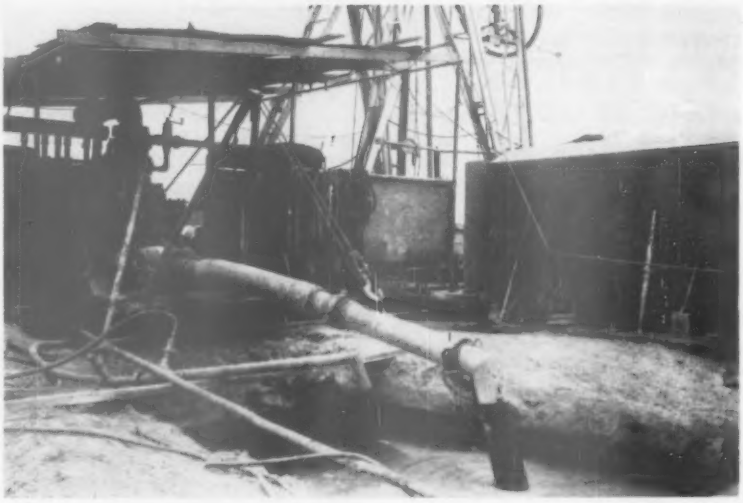
Can you use these drilling ideas?

A LOT of good ideas are being put to use on drilling rigs around the country.

For instance, Herndon Drilling Co. has "winterized" its No. 5 rig in southern Illinois. It has just moved the mud pump and engine onto the rig floor. The unit can be housed and heat from the engine helps take some of the sting out of the winter wind.

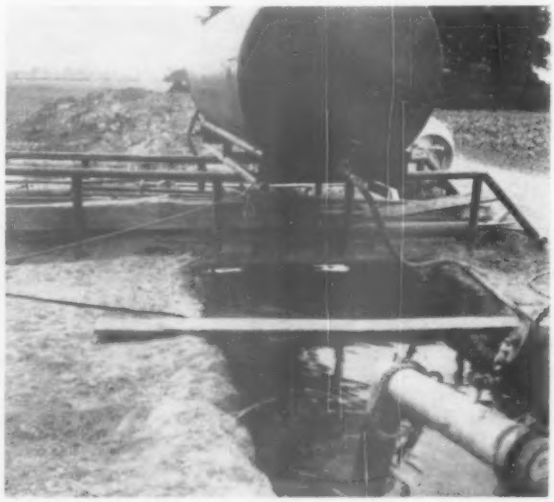
A novel way to handle drill pipe is being used at Hallmark Petroleum & Drilling Co.'s No. 5 rig in Kay County, Oklahoma.

Here, in pictures, are these and other tips which you might use.



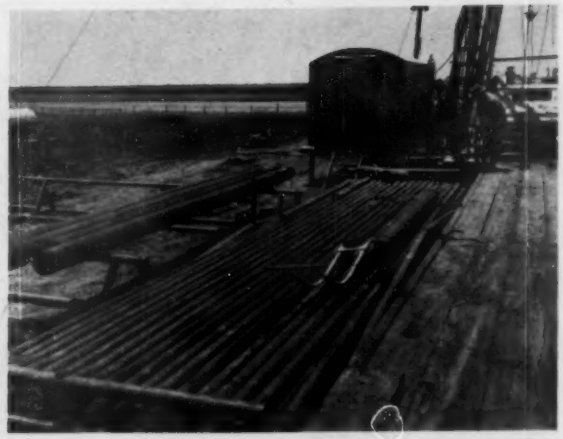
"W.NTERIZED" rig helps on cold days. Herndon Drilling Co. has moved the mud pump and engine onto the derrick floor. Unit can be housed and the crew can take advantage of heat from the engine.

HERE'S A TIME SAVER. A sub is welded to the top of the bail on the swivel and the same elevator can be used both to handle pipe and to drill.



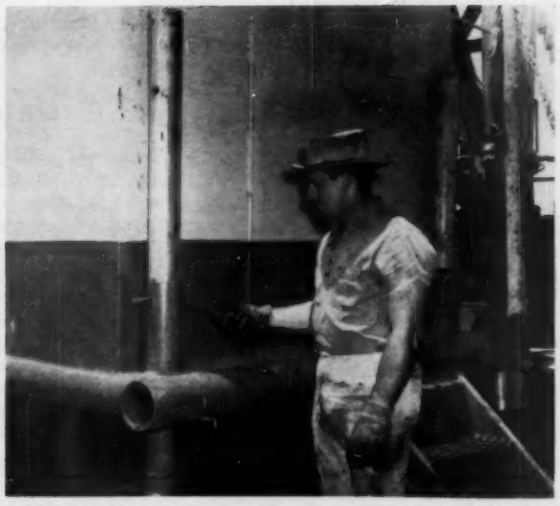
WATER TANK is mounted atop the spare-pipe bin and the whole thing is set across the mud suction pit. If tank overflows, water will just drain into the pit.

WHEN THE DRILLER needs another joint, the roughneck slips the hook into the front end of the nearest pipe and lays it on the L-shaped support this man is holding at the side of the catwalk. When the cat line is slack, the weight of the tool joint is enough to make the pipe fall over onto the catwalk ready to be taken onto the rig. The procedure is reversed when taking drill pipe down at the completion ot a well.

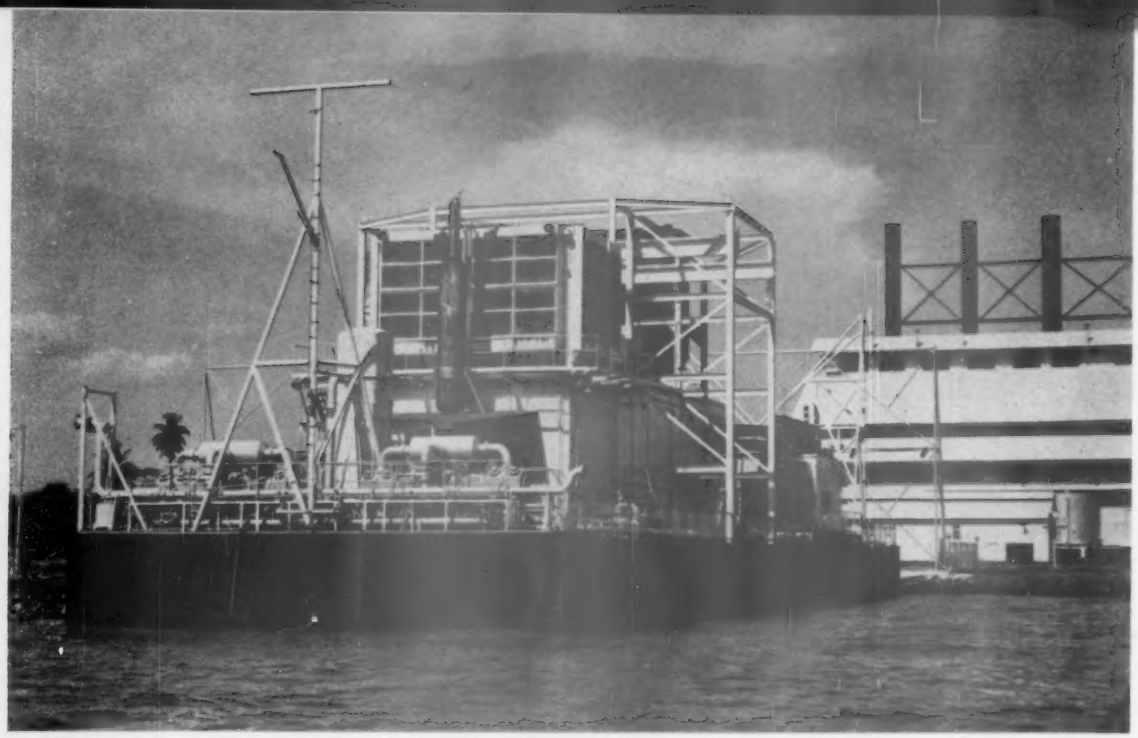


TOOL BOX is built into the pipe bin to make fewer trips for the trucks when changing locations.

BRACKET holds measuring line when running straight-hole surveys. Hallmark's Dave Wolfe is fastening the line into position.



ROUGH GROUND is no problem for this doghouse. Adjustable legs make it easy to align. They can be removed for easy loading at moving time.



BARGE MOUNTED, turbine-driven generating station on test at Punta Gorda, Venezuela. The 15,000-kw. unit was built to meet the demand for mobile, emergency power, and now . . .

Lake Maracaibo has a new floating power plant

Featuring a gas-turbine drive, this barge-mounted generating station will develop 15,000 kw. of electrical energy. The unit is completely self-contained on a steel barge 50 by 200 ft. The generating system may be controlled from aboard the barge or from a remote location, and the entire unit may be moved to any location on the lake to provide electric power in an emergency.

BY S. P. STONE
Creole Petroleum Corp.,
Maracaibo, Venezuela
and
P. R. BEARD
International General Electric Co.,
New York

THIS IS THE FIRST of two electric generating barges to be placed in service by Creole Petroleum Corp. on Lake Maracaibo, and represents the first time that a turbine of this size has been installed aboard ship.

The barge will be normally anchored in a shallow basin outside of Creole's central power plant at Punta Gorda, but can be moved and put into service on short notice.

Hull and Superstructure

All equipment is mounted above deck on a nonpropelled, all-welded steel barge 200 ft. long by 50 ft. wide by 13 ft. deep, with a draft of 4½ ft. and a superstructure not exceeding 50 ft. above water.

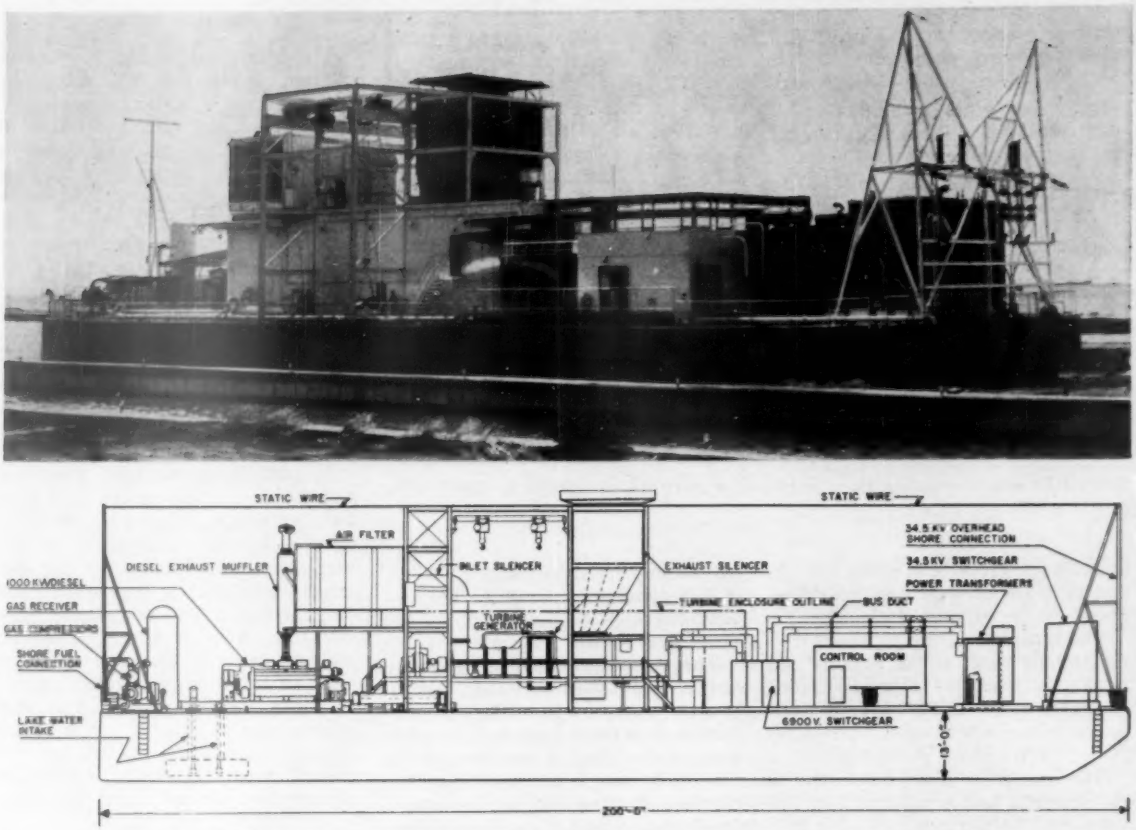
Presented at AIEE Petroleum Industry Conference, Long Beach, August 23-26, 1959.

The unit is designed for operation under rather severe atmospheric conditions, such as, winds up to 70 m.p.h., waves 6 to 8 ft. high at 100-ft. intervals, and tropical temperature and humidity conditions. Under such conditions it is expected that the barge will not exceed its design maximum of 5° pitch and 15° roll while floating free and unanchored. Properly anchored the pitch will be reduced to 3° and the roll to 10°.

To prevent capsizing the barge hull is compartmented with airtight bulkheads so that it will maintain stability with the loss of any 2 of its 15 compartments. The hull is classified by the American Bureau of Shipping for short coastwise service.

For corrosion protection the interior of the barge is painted with a semisolid, petrolatum-base rust preventative pigmented with pure metallic zinc. The exterior of the barge hull is given a zinc primer—followed by four coats of marine-type vinyl paint. In addition, magnesium anodes are used around the barge periphery for added corrosion protection.

The equipment on the barge may



STARBOARD SIDE of the new barge, top, with major equipment items detailed in the side elevation.

be grouped into three main categories:

1. The gas-turbine generator and its auxiliaries.
2. The fuel-handling system on the input side of the turbine.
3. The electrical system on the output side of the generator.

In addition the barge has an air-conditioned control room, a diesel generator for standby electric power, electric hoists for heavy equipment, fire-protection and marine-safety equipment, and convenience facilities.

The turbine generator and many of the auxiliary devices are protected from the elements by a ventilated housing located amidships; the fuel-system equipment is at the aft end of the barge; the electrical equipment at the bow. This arrangement provides maximum separation, for safety reasons, between the fuel system and the spark-producing devices of the electrical system.

Gas-Turbine Generator

The gas-turbine-generator unit consists of five major assemblies, arranged in line axially as follows:

1. Starting motor.
1. Accessory gear and clutch assembly.
3. Gas turbine.
4. Generator.
5. Exciter.

The starting motor, accessory gear, and clutch assembly are used for cranking the turbine during startup until the unit fires and becomes self-sustaining. The motor is a 550-hp., 2,400-volt, 3-phase, 60-cycle, wound rotor induction motor coupled to the gas-turbine shaft, at the compressor end, through an overriding jaw-type clutch-and-gear assembly. It is disengaged automatically from the turbine shaft at approximately 55% of full speed.

A turning-gear assembly, driven by a 5-hp., 440-volt motor, is also included. It has several functions:

1. As a breakaway assembly, it provides the initial starting torque, thus reducing the power requirements of the cranking motor.

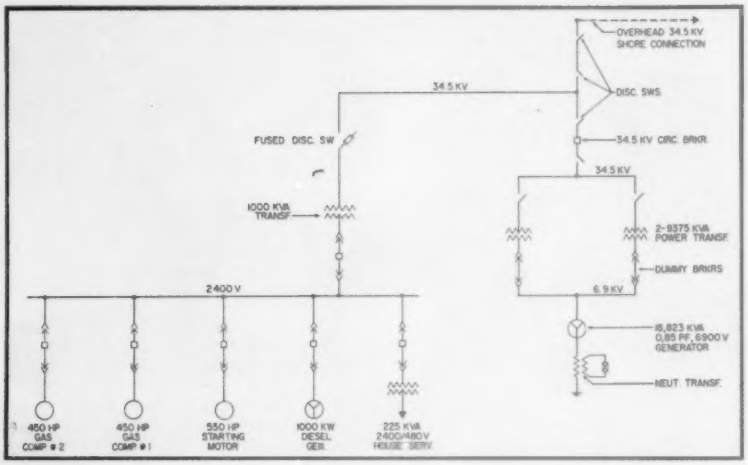
2. As a turning device, it keeps the shaft rotating slowly during the cool-down period to provide for uniform cooling of the turbine rotor.

3. As a jacking device, it can be used to rotate the rotor through small increments for making an inspection.

The turbine is a simple-cycle, single-shaft, 3,600-r.p.m. unit rated 16,000 kw. at standard NEMA rating conditions of 80° F. air temperature and 14.17-psi. pressure, which corresponds to air pressure at 1,000-ft. elevation. Under Lake Maracaibo conditions, with high ambient temperatures and sea level, the gas turbine will develop 15,200 kw.

The gas turbine. This assembly consists of a 15-stage axial-flow air compressor, 16 combustion chambers, and a 2-stage gas turbine. Atmospheric air is drawn into the compressor through air filters; it is compressed to about 90 psia. and discharged directly to the combustors. In the combustion chambers, either gas or liquid fuel is fed to the hot compressed-air stream, and at about 20% of rated speed the fuel and air mixture is ignited by spark plugs. Crossfire tubes which interconnect the 16 combustors, enable the flame from the fired chambers to propagate to the unfired chambers. Two flame detectors are installed in the combustion system to detect flameout and to initiate shutdown of the turbine in event of flameout.

The compressed air, after passing through the combustors where it is heated to approximately 1,450° F., drives the two-stage turbine. In the two stages, in which the energy split is roughly equal, the gases expand to



SIMPLIFIED one-line wiring diagram of major electrical equipment on the floating power plant.

atmospheric pressure at about 830° F. and then are dissipated to the atmosphere by the exhaust stack.

The generator is directly coupled to the turbine shaft at the exhaust end of the turbine. It is an air-cooled generator rated 18,823 kva. at 0.85 power factor, 6,900 volts, 3 phase, 60 cycle, 3,600 r.p.m., wye-connected.

The exciter is direct-connected to the generator and is rated 63 kw., 250 volts d.c., 3,600 r.p.m.

The over-all length of the turbine-generator assembly is approximately 65 ft., and the width 15 ft. It is supported above deck on a structural steel base and the foundation is designed to limit deflection to 0.005 in., which is within safe operating limits for the gas turbine regardless of equipment, wind, or wave loads. The centerline of the gas-turbine shaft is approximately 10 ft. above deck.

Fuel System

The gas turbine is designed to burn either liquid fuel or gas. It is possible to change from one type of fuel to the other under load without shutdown. This changeover is completely automatic after being initiated by a permissive switch in the control room.

If the generator is operated in parallel with other generators during fuel changeover, generator frequency will be held constant but generator load will vary slightly as a function of the heating values of the two types of fuel. If operating alone, the required load will be carried and speed variation will be held to a minimum by the governor.

The liquid fuel suitable for use with this unit is Esso C-6 diesel which can be used directly without any treatment or preheating to assure proper atomization. The heat rate at full load using distillate fuel is 16,200 B.t.u. per kw.-hr., or approximately 46 bbl. of C-6 diesel per hour at 15,000 kw., assuming a heating value of 19,300 B.t.u., per pound.

The liquid-fuel-handling system is simple and straightforward. Fuel is brought to the barge through a small flexible hose from shore or from a fuel barge, either directly into the gas-turbine fuel-control system if the line pressure is about 100 psi., or into a small storage tank if the line pressure is low. A small booster pump is used to bring the pressure up to the desired level when feeding the gas turbine from this auxiliary oil-storage tank on the generator barge.

The gas-fuel-handling system is considerably more elaborate. The gas pressure required at the turbine is 150 psig., which is higher than the pressure of gas available at the Punta Gorda power plant. To boost the incoming gas to the required pressure, two full-capacity, reciprocating-type gas compressors are installed at the aft end of the barge with a capacity of 5,150 standard cubic feet per minute (based on 14.7 psia. and 60° F. with a suction pressure of 50 psig. and discharge of 150 psig.). Each compressor is driven by a direct-connected 450-hp., 400-r.p.m., 2,300-volt, 3-phase, 60-cycle, synchronous motor.

The gas connection to shore is made by 8-in. flexible hose through a centrifugal-type, axial flow separator to the suction side of the gas compressors. The compressors discharge into a header connected to a 400-cu.-ft.-capacity gas-receiver tank, and then through an aftercooler into the turbine fuel-control system.

The heat rate using gas is 16,500 B.t.u. per kw.-hr., or 265,000 cu. ft. per hour at full load assuming a heating value of 1,000 B.t.u. per cu. ft.

Electrical System

The simplified electrical one-line diagram shows that the 6,900-volt output of the generator is connected by bus duct and dummy breakers to two 9,375-kva. power transformers in parallel, which step up the voltage to 34.5 kv. The transformer output is connected by cable to 34.5-kv. outdoor switchgear, used for synchronizing purposes, at the bow end of the barge. From the 34.5-kv. switchgear connections are made to an overhead dead-end structure from which power connections are made by overhead wires to shore. Overhead static wires and station-type lightning arresters mounted on the dead end structure are used for lightning protection.

In addition to the basic generator and switchgear equipment, a 1,000-kw., 2,400-volt, 3-phase, 60-cycle diesel generator is installed on the barge to provide local power requirements during startup, thus making the barge power plant completely self-sufficient. Another 60-kw., 480-volt, 3-phase, 60-cycle diesel generator is installed on the barge to provide power during standby periods. This unit is also used to provide power for a 7½-hp. air compressor required for control system air supply and for air starting the 1,000-kw. diesel generator.

Control Facilities

The major control equipment is installed in a control house forward of the turbine housing. Within this control house are four rooms as follows:

1. The air-conditioned, soundproofed control room containing the turbine-control panelboard, miscellaneous starters, relays, motors, control switches, and generator synchronizing devices. Control-panel vibration is minimized by spring vibration dampeners.

2. A battery room with a heavy-duty nickel-cadmium storage battery and charger to provide 125 volts, d.c. for control and emergency power.

3. A resistor room for housing the resistor bank for the 550-hp. wound-rotor induction-type starting motor for the turbine.

4. Convenience and storage facilities.

The control features of the barge power plant are unique in that the unit may be started, stopped, and controlled not only manually by an operator on the barge but also automatically from a remote-control point by means of direct-wire supervisory control. During initial startup an operator is required on the barge to set up the various valves for normal operation; once set up, these manually operated valves do not require repositioning in normal operation. There-

after fully automatic operation can be effected since all valves which require repositioning in remote start, operation, or shutdown are remotely operable and are incorporated in the automatic control scheme.

The remotely located control panel is installed in the control room for the existing steam plant at Punta Gorda. The Punta Gorda operator can do the following:

1. Start and stop the gas turbine generator unit automatically.
2. Vary the generator output voltage and load.
3. Change fuel from gas to oil, or vice versa.
4. Open the generator load circuit breaker on emergency basis. Normal closing of this breaker is controlled by the automatic synchronizing equipment on the barge.
5. Control the barge lighting.

The above remote control is performed by supervisory equipment requiring only a single pair of wires between the barge and the Punta Gorda control room. Additional control wires are installed, however, for barge-to-shore communication, telemetering of generator output information, pilot wire relaying of the barge to shore electrical connections, and annunciator indications.

Miscellaneous Equipment

The cooling-water requirements for gas turbines are usually very low; in this unit, only 550 g.p.m. of water at 95° F., or lower, are required. This is provided by two full-capacity 25-hp.-cooling-water pumps.

Parts of the pumps and the heat exchangers, which are in contact with lake water, are made of suitable materials to prevent or minimize corrosion. The cooling-water intake and discharge are located at opposite corners of the barge to minimize recirculation of the hot discharge.

The turbine-generator lubricating system uses a shaft-driven oil pump, a 75-hp. auxiliary oil pump, and two oil reservoirs designed to assure adequate lubrication during extreme roll and pitch of the barge.

Two 12½-ton electric hoists are provided on the barge for use in maintenance operations. Sufficient laydown space, adequately reinforced, is available on the barge deck to permit removal and storage of turbine appurtenances without injury or deformation of the barge deck.

To minimize the fire hazard, wherever possible gas and liquid-fuel-handling equipment, lines, relief vents, and tankage are located at a maximum distance from electrical equipment. The turbine housing is designed free of pockets or dead space that may trap gases and is freely ventilated. The area is automatically purged prior to startup of the unit. As an added precaution carbon dioxide bottles and piping are installed at the generator, and hand fire extinguishers are mounted on brackets at critical areas. The oil-filled transformers are installed in a shallow well sized to contain all of the transformer oil in the event of tank rupture. This well drains overboard by pipe to below water level.

Shore Installation

The floating power plant is installed in a dredged basin adjacent to Creole's existing steam electric power plant at Punta Gorda on the east shore of Lake Maracaibo. The basin and approach channel were dredged to a depth of 10 ft., and this facility was sized to accept up to two additional units. The edge of this basin is riprapped to minimize erosion and silting.

The gas-fuel supply for the unit is tapped off the existing gas supply for the Punta Gorda plant. For liquid fuel, a 5,000-bbl. storage tank was installed on shore. A spit approximately 250 ft. long and 30 ft. wide was constructed from shore jutting into the basin to permit access to the barge, and to provide mooring facilities and underground installation of fuel lines and electrical control cables. The underground lines and cables are brought to surface terminal devices at appropriate locations, and then connections are made to the barge by flexible hose or cable as required.

The high voltage output of the barge generator is conducted to shore via overhead wires to a shore dead-end structure, and thence to the Punta Gorda power-plant substation by underground cable in ducts.

Although installed inshore, this floating power plant is capable of operation in waters up to 100 ft. deep provided wave and wind conditions are such as to limit pitch to 5° and roll to 15° maximum. Its ability to operate successfully in either shallow or deepwater facilitates the relocation of this unit under emergency conditions, or to meet power requirements in a rapidly developing oil-producing area in the lake.

In addition to the mooring facilities and fuel and electrical connections, one very important shore installation is the control equipment previously mentioned.

Conclusion

The decision to depart from steam generation in making the latest addition to Creole's Punta Gorda steam electric plant at Lake Maracaibo was predicated on economic and operating considerations. The decision was influenced somewhat by the success with gas turbines in gas-conservation plants in Lake Marabaico. However, of more importance were the following considerations:

1. The initial cost of a gas-turbine-generator installation is lower than a comparable steam-turbine unit for Lake Maracaibo conditions.

2. Being a more compact unit, the gas turbine is more suitable for barge mounting than a steam unit with its steam-generating facilities, rather extensive auxiliary equipment, and high cooling-water requirements.

3. Operating personnel requirements of a gas-turbine unit are lower than for a similar steam unit.

4. The gas turbine is more suitable for service where quick startup and fully automatic or remote operation are desired.

Offsetting somewhat the above advantages of a gas turbine are its lower over-all thermal efficiency and poor heat rate at partial loads. This is particularly true of simple-cycle, single-shaft, gas-turbine units. However, thermal efficiency becomes of secondary importance in an area where fuel costs are low, such as in oil-field operations.

Barge mounting of the unit offers obvious advantages over fixed-station installation. A mobile power plant can be used to advantage in emergencies or to cope with a major shift of electrical load during expanding operations. The alternative of making overhead extensions to remotely located major load areas is prohibitive cost-wise where such extensions are made in fairly deep water. Submarine cable extensions can be made to such remote loads, but the amount of power that can be delivered to a remote point by submarine cable is rather limited.

An additional advantage of barge mounting of the gas-turbine unit is the fact that the unit can be completely assembled in a shipyard located near the source of supply for all equipment required for the project. Delays often encountered on foreign construction projects due to incomplete material shipments and scarcity of skilled labor can thus be minimized. For example, the unit described herein was built, checked out, run at partial load, and shipped overseas in less than 2 years; whereas steam-plant additions of this size usualy require well over 3 years to complete.

The cost of the complete installation including shore facilities and mooring provisions at Punta Gorda was about $210 per kw., which compares favorably with similar size installations during 1957 in the United States.

19. How to obtain a K_g/K_o curve from laboratory unsteady-state flow measurements

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and

F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

GIVEN: Unsteady-state relative-permeability-ratio data were obtained on a core having at pore volume of 1.25 cc. using a pressure differential across the core to 100 psi. (Table 1). Other data measured were downstream pressure = 0 psig., oil viscosity = 31.0 cp., gas viscosity = 0.0185 cp., atmospheric pressure = 14.7 psia., water saturation = 0.25.

FIND: The relationship between the permeability ratio, k_g/k_o, and total liquid saturation using the Welge[2] approach.

METHOD OF SOLUTION: The following equations will be used in the development of the solution in Table 2:

$$S_g = N_p/P.V. \quad (1)$$

$$p = \frac{p_1 + p_d}{2} \quad (2)$$

$$G_{pm} = (G_p/P.V.)\ (p_d/p) \quad (3)$$

$$G_{im} = G_{pm} + S_g \quad (4)$$

$$f_o = \frac{d\,S_g}{d\,G_{im}} \simeq \frac{\Delta S_g}{\Delta G_{im}} \quad (5)$$

$$k_g/k_o = \frac{(1 - f_o)\,\mu_g}{f_o\,\mu_o} \quad (6)$$

$$S_{gd} = S_g - f_o\,G_{im} \quad (7)$$

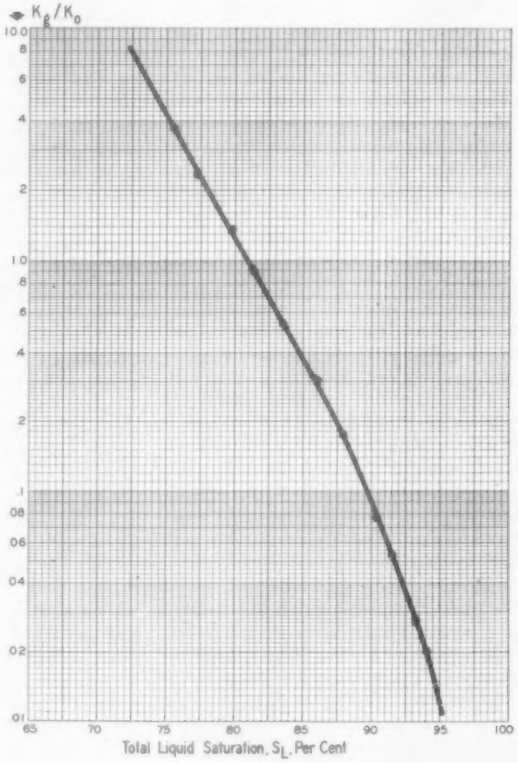
$$S_L = 1 - S_{dg} \quad (8)$$

Where:

S_g = average gas saturation in core, fraction.
N_p = cumulative oil production at outlet pressure and test temperature, cc.
P.V. = pore volume, cc.
p = average pressure, psi.
p_1 = inlet pressure, psi.
p_d = outlet pressure, psi.
G_{pm} = cumulative gas production at mean pressure and test temperature expressed in pore volumes.
G_p = cumulative gas production at outlet pressure and test temperature, cc.

TABLE 1—UNSTEADY-STATE RELATIVE-PERMEABILITY-RATIO DATA

Run No.	(1) Time, seconds	(2) $N_p + G_p$ cumulative oil plus gas production, cc.	(3) N_p cumulative oil production, cc.
1	0	0	0
2	60	1	0.071
3	80	2	0.090
4	100	5	0.110
5	140	9	0.130
6	180	16	0.148
7	240	31	0.174
8	360	77	0.210
9	510	155	0.245
10	660	260	0.272
11	840	410	0.295
12	1,175	710	0.325
13	1,460	1,060	0.345
14	1,795	1,510	0.361



VARIATION of permeability ratio with total liquid saturation. Fig. 1.

f_o = oil production, fraction of total production.
G_{im} = cumulative injected gas at mean pressure and test temperature expressed in pore volumes.
k_g/k_o = permeability ratio, gas to oil.
μ_g = viscosity of gas at mean pressure and test temperature, cp.
μ_o = viscosity of oil at mean pressure and test temperature, cp.
S_{gd} = gas saturation at outlet end, fraction.
S_L = total liquid saturation, fraction.

EXAMPLE CALCULATION: Run No. 3 will be used to demonstrate the method.

$$S_g = \frac{0.090}{1.25} = 0.0720$$

$$p = \frac{114.7 + 14.7}{2} = 64.7 \text{ psia.}$$

$$G_{pm} = \frac{G_p}{1.25}\,\frac{14.7}{64.7} = 0.1818\ G_p$$

$$= (0.1818)\ (1.910) = 0.347$$

$$G_{im} = 0.347 + 0.0720 = 0.4190$$

$$f_o = \frac{S_g\,80 - S_g\,60}{G_{im}\,80 - G_{im}\,60}$$

$$= \frac{0.0720 - 0.0568}{0.4190 - 0.2258} = \frac{0.0152}{0.1932}$$

$$= 0.07867$$

$$k_g/k_o = \frac{(1 - 0.07867)}{0.07867}\,\frac{0.0185}{31.0} = 0.00699$$

$$S_{gd} = 0.0720 - (0.0787)\ (0.419)$$

$$= 0.0390$$

$$S_L = 1 - 0.0390 = 0.961,$$

or 96.1%

DISCUSSION

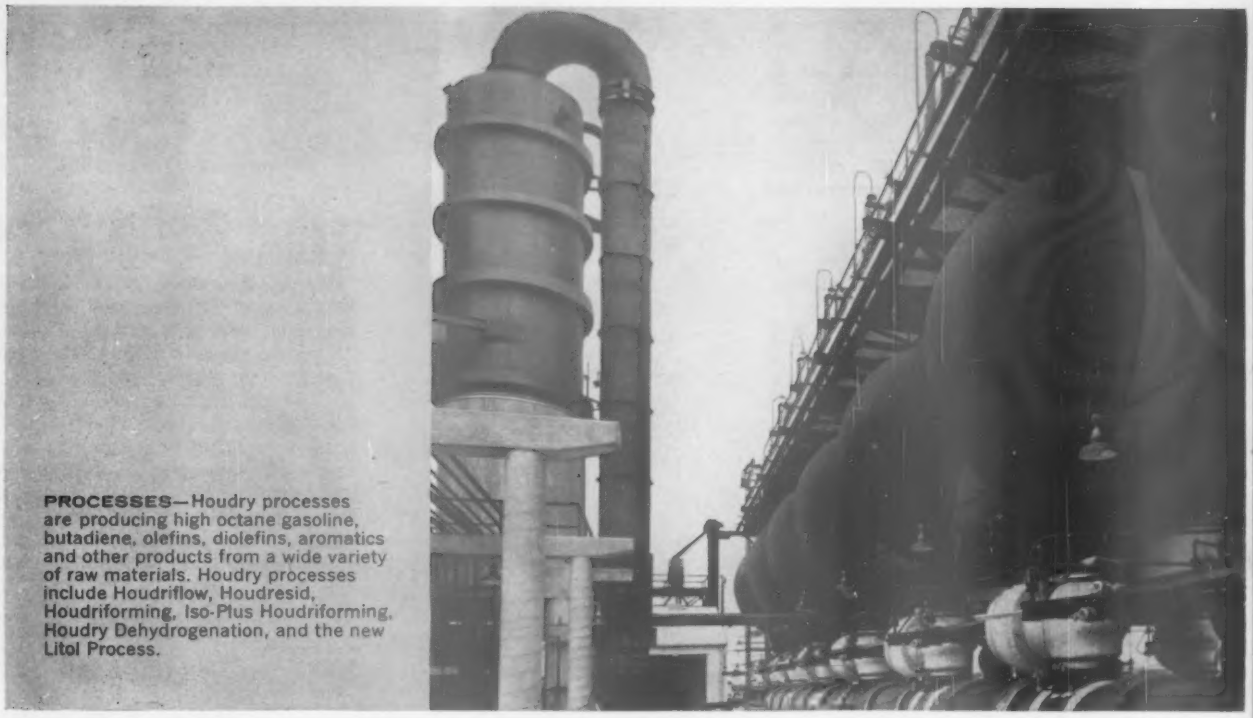
In the laboratory, gas is injected into a core saturated with oil and containing minimum interstitial water saturation. Gas and oil production are measured along with time. During the test the gas saturation varies from a maximum at the inlet end to a minimum at the outlet. This results in a continuously changing gas-oil ratio at each plane in the core. In contrast, fluid saturations in the steady-state method (Part 18, OGJ, January 11, 1960) are maintained essentially con-

Table 2–Calculation Procedure and Results

Run No.	(4) S_g = ($N_p \div$ P.V.)	(5) G_p = (2) − (3)	(6) G_{pm} = (G_p/P.V.) (p_d/p) = 0.1818 G_p	(7) G_{im} = (6) + (4)	(8) ΔS_g = $(4)_{i+1} - (4)_i$	(9) ΔG_{im} = $(7)_{i+1} - (7)_i$	(10) $f_o = \Delta S_g/\Delta G_{im}$ = (8) ÷ (9)
1	0	0	0	0	.....	.....	.....
2	0.0568	0.929	0.169	0.2258	.....	.....	.....
3	0.0720	1.910	0.347	0.4190	0.0152	0.1932	0.07867
4	0.0880	4.890	0.889	0.9770	0.0160	0.5580	0.02867
5	0.1040	8.870	1.613	1.7170	0.0160	0.7400	0.02162
6	0.1184	15.852	2.882	3.0004	0.0144	1.2834	0.01122
7	0.1392	30.826	5.604	5.7432	0.0208	2.7428	0.00758
8	0.1680	76.790	13.960	14.1280	0.0288	8.3848	0.00343
9	0.1960	154.755	28.134	28.3300	0.0280	14.2020	0.00197
10	0.2176	259.728	47.219	47.4366	0.0216	19.1066	0.00113
11	0.2360	409.705	74.484	74.7200	0.0184	27.2834	0.00067
12	0.2600	709.675	129.019	129.2790	0.0240	54.5590	0.00044
13	0.2760	1,059.655	192.645	192.9210	0.0160	63.6420	0.00025
14	0.2888	1,509.639	274.452	274.7408	0.0128	81.8198	0.00016

(Table 2 continued)

Run No	(11) k_g/k_o = $[(1 - f_o)/f_o] \times (\mu_g/\mu_o)$	(12) G_{im} avg. = $[(G_{im})_{i+1} + (G_{im})_i]/2$	(13) G_{im} avg. × f_o = (12) × (10)	(14) S_g avg. = $\frac{(4)_{i+1} + (4)_i}{2}$	(15) S_{gd} = S_g avg. = $f_o\ G_{im}$ avg. (14) − (13)	(16) S_L = (1 − S_{gd}) 100%
1	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....
3	0.00699	0.3224	0.02536	0.0644	0.0390	96.1
4	0.02023	0.6980	0.02001	0.0800	0.0600	94.0
5	0.02702	1.3470	0.02912	0.0960	0.0669	93.3
6	0.05261	2.3587	0.02646	0.1112	0.0847	91.5
7	0.07816	4.3718	0.03314	0.1288	0.0957	90.4
8	0.17346	9.9356	0.03408	0.1536	0.1195	88.1
9	0.30245	21.2290	0.04182	0.1820	0.1402	86.0
10	0.52772	37.8833	0.04281	0.2068	0.1640	83.6
11	0.89045	61.0783	0.04092	0.2268	0.1859	81.4
12	1.35622	101.9995	0.04488	0.2480	0.2031	79.7
13	2.38740	161.1000	0.04028	0.2680	0.2277	77.2
14	3.73065	233.8309	0.03741	0.2824	0.2450	75.5



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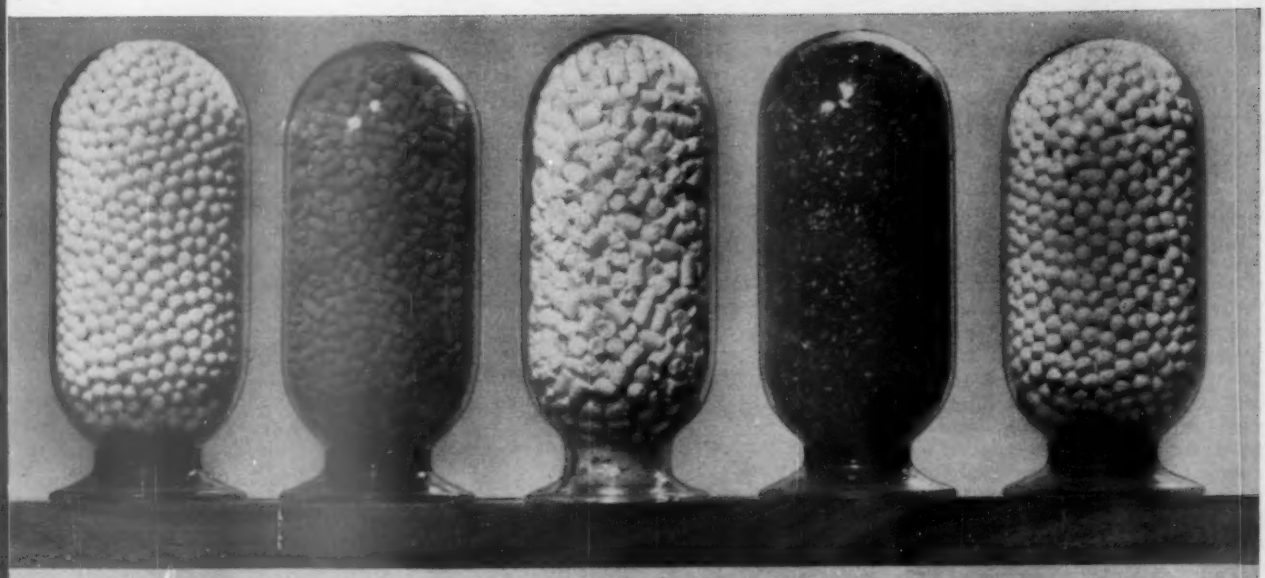

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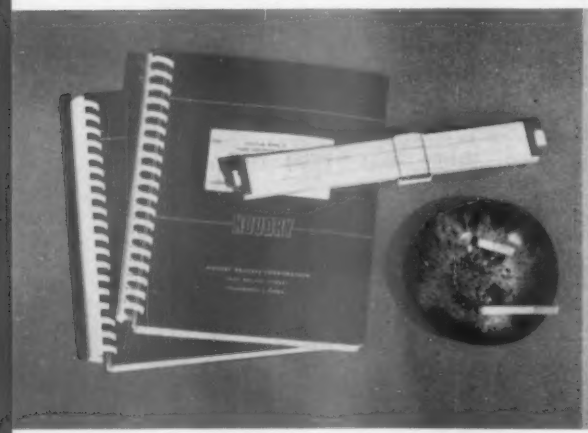

SERVICES—The wealth of experience Houdry has gained in petroleum and chemical processing is available to industry through Houdry services. These include Economic Consultation, Engineering, Research, and Technical Assistance—covering the entire range of catalytic processing.

stant throughout the core. Actually, comparable results (to steady-state results) are obtained by the unsteady-state method if the fluid saturations are determined at the outlet end where production occurs.[1]

Equations 1 through 8 are used in computing permeability ratios and compatible fluid saturations from the test measurements, Table 1. The first five equations are definitions. Equation 6 can readily be derived from the linear Darcy equation. Equation 7 was derived by Welge[2] from the Buckley and Leverett frontal-drive equation using these assumptions: (1) linear and homogeneous system, (2) negligible capillary pressure gradient at outlet end or any other point in the system, (3) gas-oil front (stabilized zone of saturation) has passed through the system, and (4) incompressible fluids.[2] In order to satisfy these requirements it is necessary to select reasonably uniform samples (using visual and X-ray or other techniques), use relatively high flowing pressure gradients (to minimize capillary end effect), and use a 25 to 30-cp. oil (to minimize effect of stabilized zone of saturation). The requirement of incompressible fluids has not been found to be too vital.[1] Computation of the gas volume at mean pressure conditions gives sufficiently accurate results.[2]

Table 2 represents solutions of Equations 1 through 8 at designated times beginning at 60 seconds. Note that this table starts with Column 4 as a continuation of the three columns in Table 1. The differential represented by Equation 5 is approximated by incremental relations and numerically computed. This is sufficiently accurate if enough data are recorded so that the plot of S_g vs. G_{im} is reasonably represented by linear segments between the data points. The value of dS_g/dG_{im} can also be determined from the graph (S_g vs. G_{im}) by drawing a tangent at each data point and evaluating the slope. This latter procedure is tedious and often no more accurate than the former.

Fig. 1 shows the results in a graph typical of k_g/k_o curves, and is representative of a single sample and not necessarily the average for a lease or reservoir. It is necessary to run several samples in an attempt to establish an average curve, and this can become expensive. Often an average laboratory-determined curve based on a few samples is used as a guide in drawing a curve based on limited production data. This latter technique will be covered in a subsequent problem.

Finally, it is well to consider the arguments of those who do not believe that relative-permeability tests adequately represent multiphase flow. The basic equations that utilize permeability ratios are derived assuming a very small unit volume through which the fluids of interest flow uniformly. Work of Chatenever[3] shows that multifluid flow does not often occur in individual pores. That is to say, in certain channels oil alone will be flowing while in others gas alone will flow. The extent to which these deviations affect the results remains to be proven in practical applications. In fact, permeability ratios are now being more widely used and have been found, in many cases, to give reasonable answers.

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Nelson Refinery Cost Indexes

Published in the first issue each month in the Engineering Section.

Compiled by W. L. Nelson, technical editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis):

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1956	1957	1958	Sept. 1959
Pumps, compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.5
Electrical machinery	134.9	160.0	175.0	188.9	192.7	197.7
Internal-combustion engines	126.0	150.5	164.0	173.9	178.3	178.8
Instruments	127.8	154.6	182.1	187.4	194.9	204.1
Heat exchangers	140.0	171.7	190.7	203.6	181.2	177.1
Misc. equipment average	*126.2	160.7	180.5	192.1	192.4	196.8
Materials component	149.5	174.6	190.4	201.9	204.2	208.1
Labor component	144.0	183.3	198.2	208.6	220.4	235.8
Nelson construction index	146.2	179.8	195.3	205.9	213.9	224.7

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis):

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1957	1958	Aug. 1959
Fuel cost	49.6	81.0	86.5	112.4	102.6	104.1
Labor cost	73.1	88.7	90.9	106.1	105.0	‡96.8
Wages	52.4	81.5	88.7	104.1	105.4	109.1
Productivity	68.3	90.2	97.1	98.1	100.3	112.8
Investment, maintenance, etc.	51.2	83.6	92.0	105.4	109.5	114.9
Chemicals cost	37.0	72.1	85.7	102.2	104.4	107.7
Operating cost indexes:						
Refinery	58.5	80.5	88.7	106.4	105.9	109.4
Process units†	62.9	82.2	88.4	107.1	105.8	103.7

†Add separate index for chemicals, if any are used. ‡This extremely low cost is an isolated case, not a downward trend.

How Panhandle Eastern combated

Five common cooling-water problems

Water treatment using automatically controlled sulfur burners at eight installations for as much as 7 years has been successful. Annual savings in treatment costs are approximately 50% of the cost of the units which require only periodic attention. Water testing by plant personnel is not required. The equipment is simple and economical.

PART 1 OF TWO PARTS

BY J. T. RUSSELL

. . . a chemical engineer specializing in cooling-water treatment for Panhandle Eastern Pipe Line Co.'s compressor stations. He began his industrial career in 1925 treating water for a steam power plant. Previous jobs with Panhandle include plant superintendent, superintendent of the natural-gasoline department, and assistant to a vice president. He holds patents concerned with natural-gas hydrates and with water treatment. For the past 5 years he has been concerned with cooling-water problems exclusively.

IT WAS A wise committee that concluded, "Industrially speaking, water is an essential, but troublesome, raw material."[1] For the troublesomeness of water is engendered by these three of its attributes:

- Its solvent action.
- Its ability to promote reactions.
- Its ability to act as a culture medium for a host of microbiological organisms.

With reference to its use for cooling purposes, these attributes of water give rise to three problems: (1) Scale, (2) corrosion, and (3) fouling and decay. In many cases, perhaps most, attempts at alleviating or solving any one or all of these problems have given rise to two additional problems: (4) Attack of cooling-tower lumber by chemicals in the cooling water, and (5) waste disposal.

It is with treatments and methods aimed at solving, or at least alleviating, these five problems that this article is concerned. It will describe research work by Panhandle Eastern Pipe Line Co., which it is believed provides solution to four of these problems as they relate to open-system cooling water: scale, corrosion, attack of cooling-tower lumber by chemicals in the cooling water, and waste disposal. The fifth problem, that of biological fouling and decay, is yet to be solved, but mention will be made of work in progress which promises to solve this final problem.

Difficulties caused by cooling water at Panhandle Eastern's compressor stations have embraced all five of the problems above. These stations are distributed from Texas to Ohio, and the raw makeup waters vary so much in composition that it is believed the solutions found to the four water problems have wide applicability. Raw waters vary in hardness from 70 to 848 p.p.m. and in total alkalinity from 30 to 400 p.p.m. Corrosion rates of steel coupons in these waters vary from 0.8 to 21 m.p.y.

Water-Softening Experience

Originally the cooling-water makeup for all stations was softened in cation exchangers (zeolite softeners), as was common practice for compressor stations built in the 1930's. In general, the softened cooling water was fairly satisfactory, although a number of bad cases of scaling were experienced, and rapid corrosion of brass or bronze pump impellers, valves, and fittings was common.

SULFUR-BURNER installation at compressor station. Fig. 1.

The most serious problem caused by the use of softened water was the rapid attack of cooling-tower lumber by chemicals in the cooling water, particularly sodium carbonate and bicarbonate, both of which are known to cause delignification of redwood.

Substitution, by the cation exchanger, of sodium for the calcium and magnesium present as bicarbonates in the raw water resulted in equivalent amounts of sodium bicarbonate appearing in the softened water. Upon heating, the bicarbonate partially decomposed to the carbonate. The pH of the cooling water usually was between 9 and 10.

It was necessary to replace two towers after 10 years of service handling softened water, and mounting costs of maintaining cooling towers along Panhandle Eastern's line prompted an investigation of methods of conditioning makeup water, other than softening, for cooling service.

The high alkalinity of the cooling water was responsible in some degree for the rapid deterioration of the redwood towers. This was indicated by the fact that at three stations where softened water was used the cost of wood replacement averaged $164 per bay (6-ft. section of tower) per year, while at a fourth station—using raw

SCALE shown here, removed from an engine jacket, is prevented under Panhandle Eastern's water-treatment program. Fig. 2.

cooling water—the cost of wood replacement had been negligible. All of these were natural-draft cooling towers. At $164 per bay, the annual cost of wood replacement on natural-draft towers on Panhandle Eastern's system would amount to around $80,000 per year.

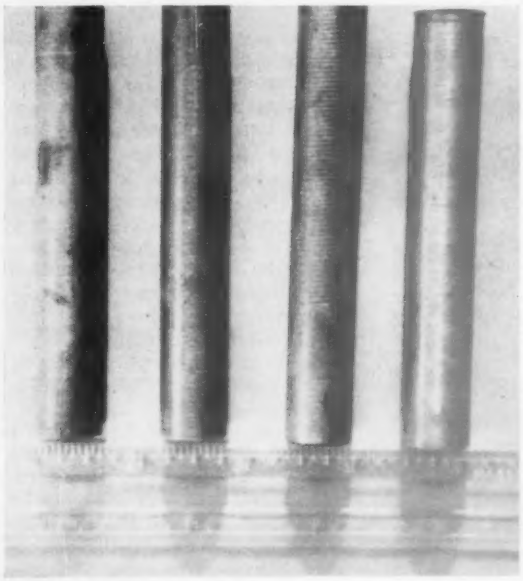
Alkalinity Reduction

Upon the premise that the high alkalinity of the cooling water was related to the high cost of cooling-tower wood replacement, methods of treatment resulting in low cooling-water alkalinities were investigated. As has been previously reported, the method of treatment chosen was that of alkalinity reduction using a completely automatic sulfur-burner installation.[2,3]

Since this equipment was first described in 1954, the use of sulfur-burner installations by Panhandle Eastern has increased from two to eight, with a ninth presently under construction. A great many improvements have been made to assure reliability and freedom from excessive maintenance.

Fig. 1 shows a sulfur-burner installation at a station. The combustion chamber is easily removed for cleaning. The maximum hardness of the raw water treated by these burners is 368 p.p.m., and the maximum total alkalinity is 263 p.p.m. The minimum amount of sulfur burned per day is around 25 lb., the maximum around 200 lb.

The change in the appearance of the cooling water when a sulfur-burner installation is substituted for a cation exchanger is quite startling—from a coffee color to near crystal clear. It is believed this change is brought about by the lessened, or perhaps minuscule, removal of extractives from the redwood of the cooling tower. Retarding or stopping the removal of extractives should add to the redwood's ability to resist fungi which cause decay.



TEST COUPONS show absence of pitting as a result of successful inhibition. Fig. 3.

Sulfur burners have been used to condition open-system cooling water only. No evidence of attack of redwood by chemicals in sulfur-burner-treated water has been noted. Twenty-six towers are presently handling sulfur-burner-conditioned water; some have handled this water for nearly 7 years. On the other hand, towers still handling water softened by cation exchange show a whitening, together with a fuzzing and softening of the surface (to a depth of 1/32 in.) after a 2-year exposure of new redwood to the cooling water.

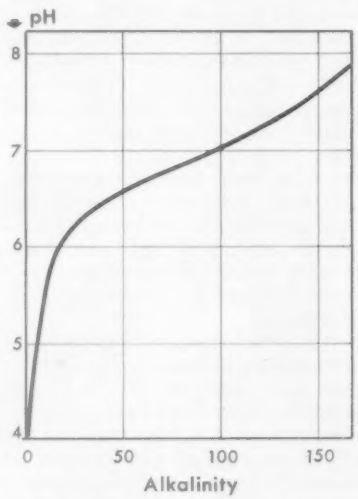
Simplicity in Concept

Panhandle Eastern's treatment of cooling water is based on simple concepts—so simple, in fact, that they are frequently overlooked.

To prevent scale formation in cooling systems, in practically all cases, it is necessary only to prevent the precipitation of calcium carbonate, known by plant men as "lime."[4,5] This is so because of, (1) the relatively high solubility (between 1,200 and 1,500 p.p.m.) of calcium bicarbonate, $Ca(HCO_3)2$, (2) the ease with which calcium bicarbonate is converted to calcium carbonate, $CaCO_3$, (lime) by gentle heating, and (3) the slight solubility of calcium carbonate.

The relatively high solubility of calcium bicarbonate accounts for the wide distribution of this compound in surface and subterranean waters. Rain, falling through the air, becomes charged with carbon dioxide, and additional quantities are adsorbed from decaying humus as ground water trickles down through rock strata. Limestone, which is composed of calcium carbonate, is widely distributed in soils and rock strata.

Limestone is practically insoluble in ordinary water, but is readily dissolved by water containing carbon dioxide, going into solution as the bicarbonate. Gentle heating decomposes the bicarbonate to the carbonate, soluble to the extent of only 18 p.p.m. This drop in solubility, from 1,200 to 1,500 p.p.m. as the bicarbonate to 18 p.p.m. as the carbonate, together with the wide distribution of limestone, accounts for



RECORDING pH controller maintains value of alkalinity which prevents lime scale. Fig. 4.

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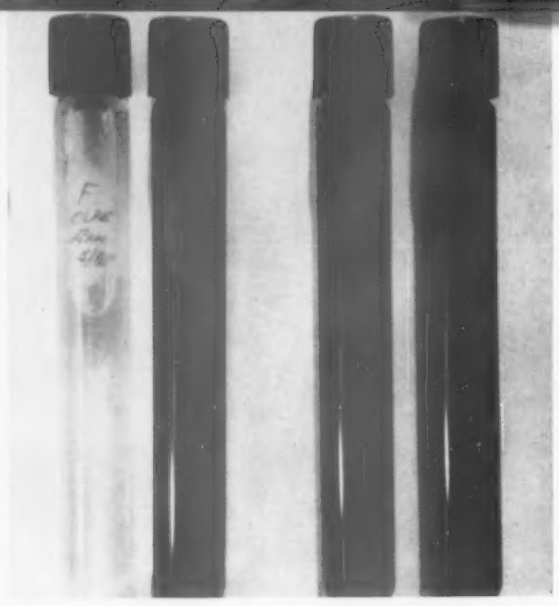
HEAVY SLIME accumulation on hot-well screen, due to biological fouling and decay, is evidence of remaining water-treatment problem. Fig. 5.



BLACK COLOR of water with sulfate-reducing bacteria is contrasted with clear sample free of bacteria. Fig 6.

the fact that practically all analyses of scale samples will show "lime" to be present in predominate amounts.

To prevent the deposition of a lime scale from water, it is necessary only to reduce the concentration of the calcium ion, Ca^{++}, or of the carbonate ion, CO_3^{--}, or of both, to such a value that their product does not exceed a certain figure corresponding to the maximum water temperature, known as the "solubility product." If the product of the Ca^{++} and CO_3^{--} concentrations exceed the "solubility product," calcium carbonate, $CaCO_3$, will precipitate until the new product exactly equals the "solubility product."

The concentration of Ca^{++} can be reduced by softening, either with a cation exchanger (zeolite) or by precipitation in a lime-soda softener. Both of these result in a softened water containing sodium which has replaced all or a part of the calcium and magnesium present in the raw water. The resulting sodium salts are quite soluble.

The concentration of CO_3^{--} can be lowered by reducing the alkalinity of the raw water with acid, usually sulfuric, or with a sulfur burner. Treatment with slaked lime will remove a part of the alkalinity. Treatment with sulfuric acid converts the alkalinity, usually present as bicarbonate, to sulfate. The sulfates of both calcium and magnesium are soluble, magnesium sulfate being very soluble, while calcium is soluble to the extent of over 2,000 p.p.m.

Thus by removing the bicarbonate, which on heating would revert to the carbonate and react with calcium to precipitate lime, we have increased the solubility of calcium from 18 p.p.m., the solubility of lime, to 2,000 p.p.m., the solubility of calcium sulfate, a gain in solubility of over 100:1.

Alkalinity Reduction vs. Softening

From a practical standpoint, scale prevention by alkalinity reduction is preferable to softening because:

(1) High alkalinities causing cooling-tower deterioration are avoided.

(2) Nontoxic, economical, and effective corrosion inhibitors are available in the pH range of reduced-alkalinity water.

A sulfur burner has a number of advantages over acid addition for alkalinity reduction:

1. **Economy**—1 lb. of sulfur, when burned, will neutralize 3.1 times as much alkalinity as 1 lb. of sulfuric acid.

2. **Safety**—acids are hazardous to handle; sulfur is easy to handle.

3. **Ease of control**—controlling a small stream of acid is difficult; controlling a large volume of combustion air is easy.

It should be mentioned that practically all, but not all, scaling conditions can be avoided as outlined above. Rarely a raw water is encountered which contains so much silica that this, rather than the solubility of calcium sulfate resulting from alkalinity reduction, limits the cycles of concentration of the water. In such cases it is usual to set the tower blowdown to limit the silica in the cooling water to 200 p.p.m.

Previously deposited scale has been removed from jackets and heat-exchange equipment as a result of Panhandle Eastern's cooling-water treatment program. (See Fig. 2.) Scale deposition also has been prevented. In Table 1 opposite Tower 1 will be found the analysis of the cooling water which served a jacket found to be clean after 3 years' operation. The ratios of Table 1 indicate balanced conditions in all cooling systems—no scale removal or deposition.

Turning to the problem of corrosion, inhibiting to mitigate corrosion in a cooling system resolves itself into providing a barrier to limit contact of water with metal composing the system. For all the three elements necessary for corrosion to occur are ever-present in an open cooling-water system: oxygen, water, and a corrodable metal.

It is not possible to exclude any of

TABLE 1—WATER TESTS AT LIBERAL STATION, MAY 9, 1959

			Alkalinity		Hardness						Ratios			
Sample	pH	Chloride (Cl)	Caustic (P)	Total (M)	Calcium (HCa)	Magnesium (HMg)	Total (H)	Sulfate (SO_4)	Total Phos. (PO_4)	Iron (Fe)	Cl	HCa	HMg	H
Raw	..	25	0	176	154	78	232	91	..	0.0				
Tower 1	5.6	45	0	7	254	142	396	397	18	0.7	1.80	1.65	1.82	1.71
Tower 2	5.8	59	0	9	335	208	543	541	40	0.6	1.31	1.28	1.46	1.37
Tower 3	6.3	68	0	14	405	245	650	628	20	0.5	1.15	1.21	1.18	1.20
Tower 4	6.4	74	0	15	440	260	700	721	23	0.3	1.09	1.09	1.06	1.08

TABLE 2—COST OF TREATMENT—1958
(cents/1,000 gal. of makeup water)

Eight sulfur-burner locations		Eight zeolite softener locations	
Inhibitor	3.55	Inhibitor	2.56
Sulfur	0.87	Salt	9.58
Algaecide	1.02	Algaecide	1.47
Detergent	0.19	Detergent	0.81
		Acid	0.05
Total	5.63	Total	14.42
Percentage of total system water-treated	67		33
Percentage of total system treatment cost	43		57
Raw Water			
Ave. hardness, p.p.m.	260		348
Ave. total alkalinity	213		218

these elements, so current practice is to add an inhibitor to the cooling water which will either react with the metal ions to form a film as these ions enter the water, or will be adsorbed on the metal surface.

The film must be only thick enough to present a barrier between metal and water, but not thick enough to interfere with heat transfer. Usually, temperatures throughout a recirculating open cooling system vary too greatly to permit use of a barrier of calcium-carbonate scale of controlled thickness, by application of the Langlier Saturation Index.

The inhibitors used today, with the exception of those containing the so-called dipolar compounds, are the same as were known 25 or 30 years ago: phosphate, chromate, and silicate. Improved inhibitors have been made by blending chromate with phosphate or a synergist with phosphate. Sodium silicate has not found wide application in cooling systems.

The corrosion inhibitor used where a sulfur burner is employed for alkalinity reduction is composed of sodium polyphosphate and sodium ferrocyanide[6]. Neither of these compounds is toxic, and during the 6 years this inhibitor has been in use not a single complaint regarding waste water has been heard.

Station waste water is used for stock, fish, etc. At one location, plant waste water is almost the only source of water for a stocked fish pond. However, it has been reported that sodium ferrocyanide, in sunlight, will decompose to sodium cyanide and hydrogen cyanide, both deadly poisons. Even so it has been found that the toxic threshold for certain fish is 170 p.p.m.—many times the concentration present in Panhandle Eastern's waste water.

This inhibitor has uniformly reduced the corrosion rates of steel coupons to around 2 - 3 mils per year. Normally a pH of 5.5, or slightly higher, is maintained where the inhibitor has been used, but it has been found to give only slightly lower protection when a pH of 5 is maintained. Corrosion rates in uninhibited waters run as high as 21 mils per year. Tests with brass coupons have shown rates of a fraction of a mil per year. Corrosion rates of equipment should be considerably less than that indicated by coupons. Fig. 3 shows a group of exposed coupons. Note the absence of pitting.

Simplicity in Treatment Control

A sulfur-burner installation is used to condition the water for multiple cooling systems by arranging such systems in a cascade series, with the blowdown from the initial system serving as makeup for the second system in the series, etc., the blowdown from all systems running to waste from the basin of the last cooling tower.

The recording pH controller of a sulfur - burner installation is set to maintain a pH of 5.5 in the initial cooling system, and, from Fig. 4, it will be seen this corresponds to a total (M) alkalinity of about 11 p.p.m. This value of the alkalinity has been found to prevent lime scale.

For control of cycles of concentration, or total dissolved solids, two arrangements are used. In one, a liquid level in the basin of the last tower of the multiple system maintains the height of water over the overflow weir, thus setting the rate of blowdown for all systems and the solids content of the water in the last system.

In the second arrangement, a conductivity controller with an electrode in the final system water controls the flow of makeup water from the first system to all succeeding systems, thus fixing the blowdown from the final system and the dissolved-solids content of the water therein. Makeup water to the initial system is automatically controlled.

Blowdown from the final system is set to maintain the calcium-hardness (as $CaCO_3$) content of the water in this system between 750 and 1,000 p.p.m. Nordell[8] recommends a limit of 1,250 p.p.m. but, because of the possibility of excessive evaporation from areas of atmospheric coils sparsely supplied with cooling water, it is felt a lower limit is preferable.

The limiting concentration of calcium hardness is derived from a consideration of the solubility of the calcium sulfate resulting from reduction of the alkalinity of the raw water. This is something over 2,000 p.p.m. of calcium sulfate, equivalent to about 1,470 p.p.m., expressed as $CaCO_3$. In setting the limit of 750-1,000 p.p.m. it is evident that the cooling water contains between about half and two-thirds the maximum amount of calcium hardness.

Authorities[8] have recommended that the product of the calcium, Ca^{++}, and the sulfate, SO_4^{--}, both expressed in p.p.m., be limited to 500,000, and blowdown be adjusted accordingly. No cases have come to the attention of the author in which the limits of calcium hardness mentioned above have been maintained where the product of the calcium and sulfate concentrations has approached 500,000. The hardness limits appear simpler in application.

The possibility of the polyphosphate of the inhibitor reverting to the orthophosphate form also somewhat limits the calcium hardness of water in the final cooling system and the cooling service to which this water may be applied. The polyphosphate will sequester calcium and hold it in solution; the orthophosphate will precitate calcium as tricalcium phosphate, $Ca_3(PO_4)2$.

The factors in this reversion of polyphosphate and the precipitation of $Ca_3(PO_4)2$ are: (1) time, (2) temperature, (3) pH, and (4) calcium concentration.[10] To provide for this possibility of tricalcium phosphate precipitation, water in the final system of a cascade series is used to cool atmospheric coils, where any precipitate has been found to cause no trouble.

No tests by plant personnel are needed to maintain the limits of alkalinity reduction and dissolved - solids concentration stated above. It is necessary only to calibrate the pH controller once a week and to make analyses of cooling waters in all systems every 2 or 3 months to assure that blowdown is adequate and nonscaling conditions exist in all systems.

The existence of nonscaling conditions is evidenced by the ratio of the calcium hardness in the cooling water to the calcium hardness in the makeup water to the system being equal to, or greater than, the ratio of chlorides, similarly calculated.[11]

Simple Things That Count

1. Cover the entire area of an atmospheric cooling coil with ample water. Excessive evaporation at areas of water starvation can lead to scale formation, even though nonscaling conditions exist in the system as a whole. Because of its economy and the better water distribution it affords, a tower of the spray type has replaced the natural-draft tower for gas and

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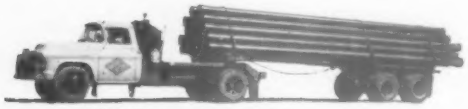

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closed-system jacket-water cooling on Panhandle Eastern's system.

2. Maintain ample flow of cooling water to engine jackets and shell-and-tube exchangers. This avoids the possibility of "hot spots" occurring as a result of stagnant flows and stratification of the cooling water. It also helps to keep any suspended solids from settling at points of low circulation.

Finally, it helps to reduce the temperature of the film of water in contact with the hot surface. The temperature of this film, not of the water as a whole, is determinative with respect to scale formation. The solubility of many scale-forming compounds decreases markedly with temperature.

There is a reluctance on the part of operators to raise the temperature of cylinder and rod water discharged from large horizontal gas engines. But at one of Panhandle Eastern's stations, by raising the inlet water to around 125° F. and by maintaining ample water flows to limit the temperature rise across the engines, it was found that cylinder and ring wear decreased markedly, as did maintenance expense.

3. Remove contaminants from the cooling water, especially oil and suspended matter. At several of Panhandle Eastern's stations a detergent is added to the open jacket-water system to solubilize oil and assure its continuous removal in the blowdown from the system. At one station using lake water for makeup, a sidestream of open-system jacket water is continuously filtered to remove suspended solids.

4. Arrange the cascade systems so that the best water is used for the most critical cooling services, such as engine jackets, shell-and-tube exchangers, and high temperatures. This will minimize the possibility of scale formation.

Biological Fouling and Decay

The one remaining problem to which no answer has been found is that of biological fouling and decay. At two stations, fouling by slime is sufficient to cause frequent cleaning of water screens and accumulations of slime muck in the bottom of jackets. Fig. 5 shows a heavy accumulation of slime on a hot-well screen. At two stations, sulfate-reducing bacteria are causing extensive waterside corrosion of engine jackets. Slabs composed mainly of magnetic iron oxide have been taken from jackets of engines at these stations. The odd thing is that one of these stations uses filtered, chlorinated makeup water free of the sulfate-reducing bacteria, while water from the semiclosed jacket system, with only the hot-well open to contamination from the air, shows the presence of these bacteria. Fig. 6

shows the cultures of the two waters. Also shown in Fig. 6 are cultures of open-system jacket water from two other stations showing the presence of the bacteria (black).

A great many algaecides-bacteriacides have been tried without too much long-range success. These were applied in "slug" treatments. In many of these, different algaecides were used in alternate "slugs." The author has reluctantly come to the conclusion that only chlorine is a total and economical answer to the slime-algae problem.

However, the California Redwood Association[12] has been unrelenting in the condemnation of the use of chlorine in a cooling system where a redwood tower is used, basing its position on the periodic inspection of the condition of 20 selected towers throughout the United States, and on a correlation believed to exist between towerwood deterioration and cooling-water analysis.

No doubt chlorine will have some deleterious action on wood, but the real question is this: How serious is this action in comparison to the problems caused by slime and algae? Brown[13] feels that intermittent chlorination to free residuals of 1 p.p.m. will cause no ill effect, and his view is shared by McKelvey and Brooke, loc. cit., who mention a cooling system on the Gulf Coast in which chlorine residuals up to 15 p.p.m. have for 8 years been continuously maintained for alkalinity control without causing any noticeable deterioration of the Wolmanized fir cooling tower.

After considering the facts, it was decided to install chlorinators at the two stations where slime is a serious problem and to watch the towers at these stations for evidence of wood deterioration. These chlorinators will be program-controlled by automatic timers, and it is planned to use intermittent chlorination only long enough for each cycle to maintain a 1-p.p.m. residual for a short time. Unlike other algaecides, organisms will not build an immunity to chlorine, and chlorine can be added in concentrations high enough to be effective without creating a toxic waste water and disposal problem.

If no evidence of wood deterioration caused by the chlorine is found after 1 year's use, it is planned to install chlorinators where the cooling water is conditioned by alkalinity reduction. Because of the destructive action of chlorine on wood in contact with a highly alkaline cooling water, various other algaecides will be used at those locations where the cooling water is softened by cation exchange.

One pound of sulfur, when burned, will neutralize as much alkalinity as

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3.1 lb. of sulfuric acid. With these two chemicals costing approximately the same in tonnage lots, the economy of sulfur for conditioning cooling water by alkalinity reduction is obvious. Also, conditioning cooling water using sulfur burners is more economical than softening water by cation exchange. Table 2 presents a comparison of the 1958 cooling-water treating costs for eight sulfur-burner installations and eight cation-softener installations along Panhandle Eastern's system.

The costs for the sulfur-burner installations appear in line with the reported costs of others. Whitney[14] reported the average cost of various effective inhibitors was 5.86 cents, assuming three cycles of concentration of the makeup water; and somewhat the same average costs were reported by an API committee,[15] when their data are recalculated to a cents per 1,000-gal.-of-makeup basis.

Acknowledgment

Much information presented in this paper has been developed by the station superintendent and personnel who have used sulfur burners many years.

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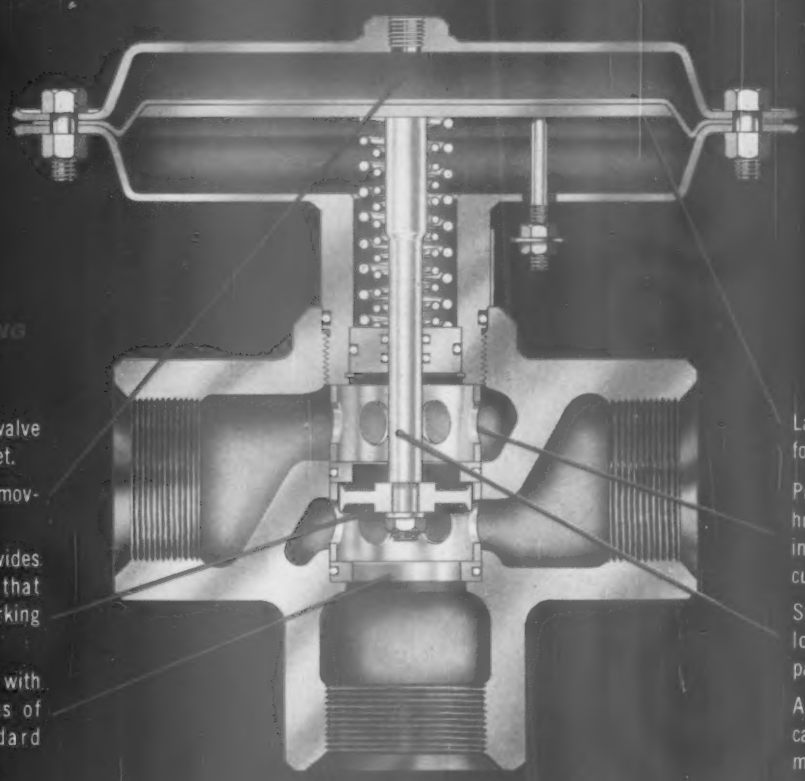

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Petrochemical, field-processing-plant construction moving ahead

PLANT CONSTRUCTION activity finds the petrochemical industry moving ahead at a fast pace to expand production facilities.

At least 70 construction projects are under way or planned in the U. S. and Canada, including 14 new projects for production of polyethylene and polypropylene facilities.

Rubber capacity, too, will be expanded considerably when the new projects are completed, with at least a half dozen such construction jobs in the mill.

Also, several petrochemical companies are expanding phenol capacity as well as facilities for production of maleic anhydride.

The following survey includes only petrochemical and field-processing projects. A complete rundown of refinery construction projects will appear in the Journal's annual Refining Issue March 28.

A

• **Allied Chemical Corp.,** Semet-Solvay Petrochemical Division, will increase capacity of its Tonawanda, N. Y., plant 50%, or a total of 30,000,000 lb. per year. Principal products at the plant are polyethylene resin pipe compound and polyethylene wax.

At Orange, Tex., Allied plans to build a new high-density polyethylene plant, with completion expected in 1960.

• **American Cyanamid Co.** will build facilities for acrylonitrile derivatives at the Fortier plant, Avondale, La.

• **Amoco Chemicals Corp.** is building the first stage in a program calling for full-scale commercialization of trimellitic anhydride at Joliet, Ill. The semi-commercial plant will be completed by mid-1960. New facilities for polystyrene production are scheduled for completion in the third quarter of 1961.

• **Ashland Oil & Refining Co.** will complete the first commercial hydrodealkylation plant to make synthetic benzene and naphthalene from petroleum in 1960 at its Buffalo refinery. The new unit will produce either 12,000,000 gal. per year of benzene or 50,000,000 lb. of naphthalene or a combination of the two products.

B

• **Borden Chemical Co.** is constructing commercial facilities for production of alcohol and butadiene and styrene at Leominster, Mass.

At Illiopolis, Ill., Borden plans to build a polyvinyl chloride plant with capacity of 40,000,000 lb. per year.

C

• **California Chemical Co.** will complete a maleic anhydride plant at Richmond, Calif., by mid-1960. It will have capacity of 20,000,000 lb. Feed stock will be benzene.

• **Canadian Oil Companies, Ltd.,** will have capacity of 80 long tons of sulfur daily at its new processing plant near Innisfail field in Central Alberta when the plant goes on stream in fall 1960.

The company has also announced plans for a $4-million expansion at its Edmonton, Alta., plant which produces formaldehyde, methanol, acetic acid, pentaerythritol, and solvents.

• **Carbide Chemicals Co.** will increase polyethylene capacity to 65,000,000 lb. per year at Montreal East, Que. Completion expected by mid-1960.

• **Carey Chemicals, Inc.,** is building polyvinyl chloride and copolymer units at Flemington, N. J., with completion expected in 1960. Scientific Design Co., Inc., New York, has contract.

• **Celanese Corp. of America** will expand capacity of its high-density polyethylene facilities at Houston from 40,000,00 lb. to 50,000,000 lb. per year. Completion scheduled first half of 1960.

• **Collier Carbon & Chemical Corp.** has obtained an 11-acre site from Union Oil Co. of California for construction of two units for production of sulfuric acid and ammonium sulfate near Wilmington, Calif. Completion is scheduled late in 1960.

• **Consolidated Mining & Smelting Co. of Canada, Ltd.,** is building a 100-ton per day urea plant at Calgary, Alta., with completion set for mid-1960. Plant will employ the Inventa-Vulcan urea process.

• **Continental Oil Co.** is building a plant at Lake Charles, La., for manufacture of petroleum-derived industrial alcohols which were formerly produced only from natural fats and oils. Capacity will be more than 50,000,000 lb. per year of straight-chain primary alcohols for use in manufacture of detergents, plasticizers, etc. Raw material will be ethylene. Contractor is Lummus Co., Houston. Completion will be early in 1961.

The company has also announced plans for construction of a petrochemical plant at Ponca City, Okla., which would have capacity of more than 20,000,000 gal. of cyclohexane per year. Hydrogen from the company's refinery will be used to convert benzene into cyclohexane. Construction is being handled by Procon, Inc., Chicago, and completion is scheduled September 1960. Cyclohexane is used primarily as a raw material in the manufacture of such products as nylon and solvents.

• **Copolymer Rubber & Chemical Corp.** will expand its Baton Rouge, La., synthetic-rubber plant in a $3-million program.

• **Cosden Petroleum Corp.** will double facilities for polybutene production at Big Spring, Tex.

• **Cyanamid of Canada, Ltd.,** is replacing coal with natural gas as a raw material for making ammonia and ammonium nitrate at its Welland, Ont., plant. The $5-million conversion program is scheduled for completion in 1960.

D

• **Dow Chemical Co.** will build a styrene-butadiene latex plant at Allyn's Point, Conn., with completion scheduled for early 1961.

Dow has also announced plans to build a new phenol plant in the Pacific Northwest. Annual capacity would be 36,000,000 lb., with completion scheduled early in 1961.

At Midland, Mich., Dow Chemical will increase capacity of bisphenol-A to total of 30,000,000 lb. by summer 1960.

Scheduled for completion in 1961 is construction of polypropylene facilities at Torrance, Calif.

At Plaquemine, La., facilities to produce polyethylene will be completed in October 1960, and facilities to produce vinylidene chloride and methyl chloroform will be completed by May 1961.

• **Dow Chemical of Canada, Ltd.,** will build facilities for caustic soda, chlorine and phenol operations in western Canada, which will lead to certain petrochemicals.

• **Du Pont de Nemours & Co., E. I.,** will add a 50,000,000-lb. per year caprolactam plant at Beaumont, Tex., based on cyclohexane. New facilities for production of acrylonitrile for internal use will also be included in expansion. The new acrylonitrile plant will use the ammonia-propylene process.

At Victoria, Tex., Du Pont is scheduled to complete a new polyethylene plant by early 1961.

At La Porte, Tex., construction is under way at a new sulfuric acid plant. Completion is scheduled by January 1961.

At Belle, W. Va., Du Pont is building a new plant to produce methylamines, using ammonia from existing plant. Completion is scheduled by first quarter of 1961.

At Florence, S. C., a new plant is under way to double capacity of Du Pont's polyester film. Estimated cost is $20 million, and completion is expected early in 1961.

At Orange, Tex., a new plant to produce linear polyethylene by a low-pressure process will be completed by mid-1960. Ethylene will be the raw material.

• **DX Sunray Oil Co.** will install a Udex unit at its Tulsa refinery to produce 600 bbl. of benzene and 300 bbl. of toluene daily. Construction will begin March 1, with completion scheduled in October 1960. Treco has the contract.

E

• **Esso Standard,** division of Humble Oil & Refining Co., is expanding facilities at Baton Rouge, La., to include facilities for brominated butyl rubber, using liquid fractions as a raw material. Also, improvements will be made to butyl-rubber feed-stock facilities.

At Bayonne, N. J., Esso's 1960 construction program includes modernization of facilities to produce pour depressants and extreme-pressure additives.

• **Ethyl Corp. of Canada, Ltd.,** is building a plant at Sarnia, Ont., to produce ethyl chloride and ethylene dichloride. Ethylene feed stock will come from refinery at Sarnia. Completion is due in 1960.

F

• **Firestone Tire & Rubber Co.,** Synthetic Rubber & Latex Division, will boost capacity of its Orange, Tex., plant by 30,000 tons per year. Facilities for production of butadiene-based rubber will be completed by late 1960. Facilities for production of isoprene-based rubber scheduled for completion early in 1961.

• **Foster Grant Co., Inc.,** will expand

Background: One of three 2500 hp Type GMWA Cooper-Bessemer compressors at Winnipeg station.

Exterior view of Winnipeg compressor station of Trans-Canada Pipe Lines.

The three 2500 hp Type GMWA compressors at Winnipeg station.

C. Robert Jones, *General Manager, Cooper-Bessemer of Canada, Ltd., explains a vital project...*

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styrene capacity at Baton Rouge, La., to 120,000,000 lb. per year in 1960.

G

• **Goodrich-Gulf Chemicals, Inc.,** is building a plant at Port Neches, Tex., for production of 13,000,000 lb. per year of a new type of high-density polyethylene. Construction, by Ralph M. Parsons Co., is scheduled for completion in late 1960.

• **Gulf Oil Corp.** is installing new plant at Philadelphia for production of 35,000,000 to 40,000,000 lb. of oxo alcohols, with completion by December 1960. Additional facilities to produce oxo derivatives to follow. Contractor for the alcohols project is Badger Manufacturing Co.

At Port Arthur, Tex., Gulf plans to boost high-purity ethylene by summer 1960. Polymer fractionation facilities will be constructed to produce propylene trimer for charging to the Philadelphia refinery's oxo unit, and for production of various polymers for detergent manufacture.

H

• **Hercules Powder Co.** will increase capacity of dimethyl terephthalate at Burlington, N. J., from 12,000,000 lb. to more than 36,000,000 lb. per year, with completion set for October 1960.

At Parlin, N. J., polypropylene capacity will be increased from 20,000,000 to 50,000,000 lb. this year.

At Lake Charles, La., Hercules is developing a new plant with capacity of more than 100,000,000 lb. per year of polypropylene. The first part of the plant is scheduled to go on stream early in 1961.

Hercules will operate the West Coast's first methanol plant near Richmond, Calif., with capacity of 8,000,000 gal. per year. New urea formaldehyde facilities are expected to be completed by mid-1960.

• **Heyden Newport Chemical Corp.** will produce maleic anhydride at a new plant at Fords, N. J. Capacity will be 24,000,000 lb. per year.

J

• **Jefferson Lake Petrochemicals of Canada, Ltd.,** plans to build two new sulfur-recovery plants, one just east of Calgary and the other in the Savanna Creek area. The first is expected to be on stream in November 1960.

M

• **Mobay Chemical Co.** is expanding its isocyanate production facilities at New Martinsville, W. Va., boosting capacity to more than 25,000,000 lb. per year.

• **Mobil Oil Co.** (formerly Magnolia) at Beaumont, Tex., will build new facilities for production of 380,000,000 lb. per year of ethylene, 100,000,000 lb. per year of propylene, and 20,000,000 lb. per year of butadiene. Completion of the $25-million project is scheduled first quarter of 1961.

• **Monsanto Chemical Co.** is increasing capacity of its bisphenol-A facilities at St. Louis. Scientific Design Co., Inc., has the contract.

Monsanto has also announced it will increase production of styrene monomer by at least 200,000,000 lb. per year, with the first stage of the new facilities expected in operation by the first quarter of 1961. These new facilities will be located somewhere in Texas.

• **Monsanto Canada, Ltd.,** will complete a new anhydride plant at Villa La Salle (Montreal) in the fourth quarter 1960. It will have capacity of 6,000,000 lb. per year. Scientific Design Co., Inc., has the contract.

N

• **Novamont Corp.** (subsidiary of Montecatini), is building a 25,000,000-lb. per year plant for production of polypropylene and other polyolefins. Completion is expected early in 1961.

O

• **Olin Mathieson Chemical Corp.** is expanding its Brandenburg, Ky., plant in a $30-million program. Products will include glycerin, epichlorohydrin, propylene oxide, propylene glycol, and polypropylene glycols. Ethylene dichloride capacity will be doubled.

P

• **Pan American Petroleum Corp.** and **Hondo Oil & Gas Co.** are building a natural-gasoline plant at Empire Abo field, Eddy County, New Mexico, with completion scheduled the first half of 1960. About 12½ long tons of elemental sulfur will be recovered daily from the casing-head gas.

• **Pantesote Co.** is building polyvinyl chloride facilities at Passaic, N. J., with completion in 1960. Scientific Design Co. Inc., New York, has the contract.

• **Phillips Chemical Co.** is expanding ethylene capacity to 290,000,000 lb. per year at the Sweeny, Tex., plant, with completion expected by the second quarter 1960.

At Borger, Tex., Phillips Chemical is expanding its polybutadiene-rubber capacity to 20,000 long tons a year. Expansion program is scheduled for completion August 1960.

At Orange, completion is scheduled in the third quarter of 1960 for a 60,000,000-lb. per year carbon-black plant.

• **Polymer Corp., Ltd.,** is planning a $15-million butadiene plant at Red Deer, Alta., with capacity between 25,000 and 30,000 tons per year.

R

• **Reichhold Chemicals, Inc.,** was scheduled to complete a $5,000,000 maleic anhydride plant at Elizabeth, N. J., in August 1960. It will have capacity of 20,000,000 lb. per year. Raw material will be benzene.

At Tacoma, Wash., Reichhold Chemicals plans to build a 30,000,000-lb. per year phenol plant.

At Tuscaloosa, Ala., construction is under way to raise capacity of the phenol facilities to 90,000,000 lb. per year.

• **Reichhold Chemicals (Canada)** is planning a phenol and formaldehyde unit.

S

• **Shell Chemical Corp.** plans to build a synthetic resins and plastic plant across the Delaware River from Philadelphia.

• **Sogenines, Ltd.** (affiliated with Ste. Generale de Belgique (Brussels), will build a $17-million synthetic rubber plant at Maitland, Ont., to be completed early in 1961. Products would include ammonium nitrate, nitrogen solutions, anhydrous ammonia, and hydrogen.

• **Stauffer Chemical Co.** will complete a carbon disulfide plant at Delaware City in November 1960. It will use sulfur from the nearby Tidewater Oil Co. refinery and methane from Eastern Shore Natural Gas Co.

• **SunOlin Chemical Co.** will build an ethylene plant at North Claymont, Del., with capacity of 200,000,000 lb. annually. Feed stock will come from Sun Oil Co.'s Marcus Hook, Pa., refinery.

T

• **Texas Eastman Co.** will have capacity for 20,000,000 lb. per year of polypropylene at plant to be completed at Longview, Tex., the last quarter 1960.

• **Tidewater Oil Co.'s** new field-processing plant in the New Hope-Smackover field of Franklin County, Texas, will have capacity of 224 long tons of sulfur daily. Completion is scheduled in fall of 1960.

U

• **Union Carbide Chemicals Corp.** will expand polyethylene production to 170,000,000 lb. per year at the Seadrift and Texas City plants. Completion is set for 1961.

• **Union Carbide Corp.** will convert the former Amoco Chemicals Corp. synthetic-fuels plant into a plant for manufacturing solvents and intermediates. Construction is scheduled to begin in April 1960.

• **Union Carbide Plastics Co.** plans to complete a 25,000,000 lb. bisphenol-A plant in Marietta, Ohio, in 1961.

• **U. S. Industrial Chemicals Co.,** Division of National Distillers & Chemical Corp., is boosting capacity of its polyethylene resin plant to 200,000,000 lb. annually at Houston. Completion is set for mid-1960.

Field-processing plants

A

• **Amarillo Oil Co.** (subsidiary of Pioneer Natural Gas Co.) is building a new plant 12 miles south of Pampa in Gray County, Texas Panhandle. Scheduled for completion by April 1960, it will have design capacity of 45,000 M.c.f. daily, with liquid production at about 52,000 gal. per day. Dresser Engineering Co., Tulsa, has the contract. The plant is being erected on the site of a compressor station built by Pioneer Natural Gas.

B

• **British American Oil Co., Ltd.,** will operate a plant at Dick Lake, Alta., about 110 miles north of Calgary. Other companies with interest in the proposed plant are Canadian Husky Oil, Ltd., Phillips Petroleum Co., and California Standard Co. Gas is under contract to Trans-Canada Pipe Line.

C

• **Canadian Oil Companies, Ltd.,** is building a $4-million plant 25 miles south of Red Deer, Alta., near Innisfail field. It will handle 4,000 bbl. of condensate daily supplied by natural-gas processing plants in the area. Production will include 2,000 bbl. of gasoline daily in addition to diesel and small amount of heating oils. Completion scheduled late fall 1960. Contractor is Canadian Bechtel, Ltd.

E

• **El Paso Natural Gas Co.** is building additional 210,000-M.c.f.-daily process capacity at Jal, N. M., with completion expected in March 1960. Contractor is Dresser Engineering Co., Tulsa.

H

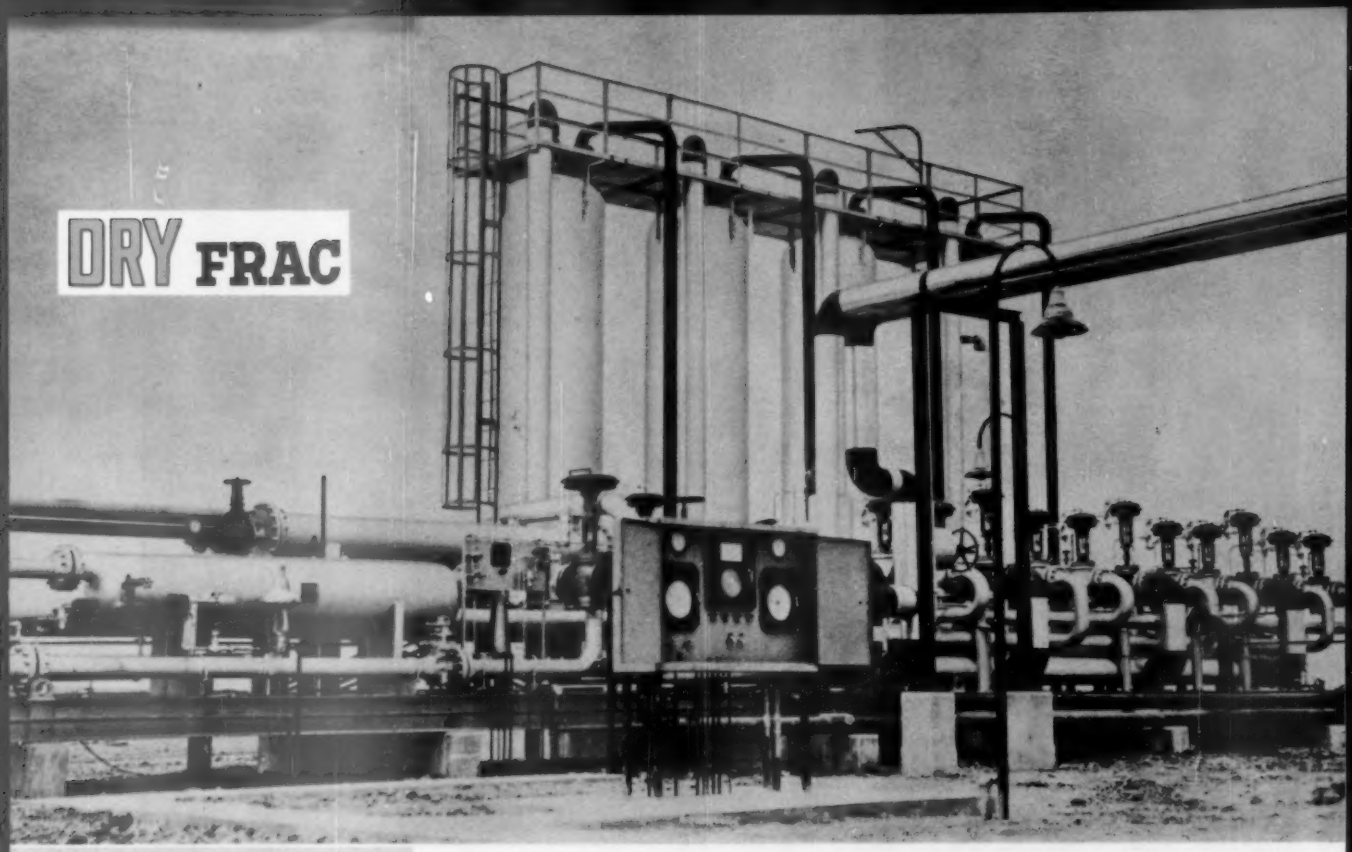
• **Home Oil Co., Ltd.,** will operate the new plant being built by the Carstairs Operators' Committee about 7 miles southwest of Carstairs, Alta. Design capacity is 66,000 M.c.f. daily of pipeline gas and 2,300 bbl. daily of debutanized condensate. Completion is scheduled in March 1960. Contractor is Fluor Corp. of Canada, Ltd.

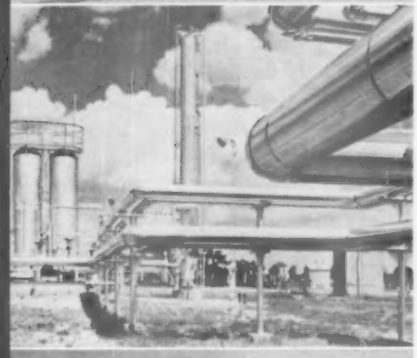
• **Humble Oil & Refining Co.** is building a plant in Kleberg County, Texas, about 15 miles south of Kingsville. Capacity of the natural-gasoline and cycling plant will be 800,000 M.c.f. daily with liquid recovery of 28,000 bbl. daily. Contractor is Hudson Engineering Corp., Houston, and expected completion is mid-1960.

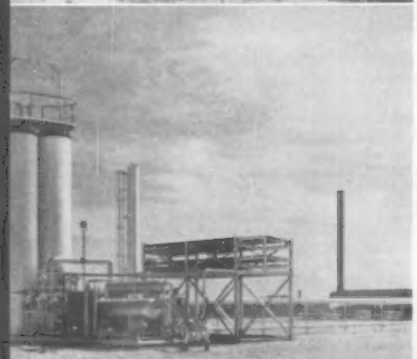
• **Hunt Oil Co.** is building a natural-gasoline plant at Alta Loma in Galveston County, Texas. Capacity will be 25,000 M.c.f. of gas daily from several fields in the area. Completion is set for spring 1960.

L

• **La Gloria Oil & Gas Corp.** has a 176,000 M.c.f. daily plant under construction in Acadia Parish, Louisiana. Comple-







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RE-EVALUATE YOUR PRODUCTION NOW!

Smart producers are taking a second look at their lean well streams and production with low available pressure drop now that DRY FRAC* makes it possible to recover hydrocarbons economically in many of these situations.

DRY FRAC is BS&B's short-cycle hydrocarbon recovery system that accomplishes dehydration to pipeline specification and hydrocarbon recovery in one operation, giving the producer added profits per dollar invested with a quick payout.

Backed by many years of engineering experience in all types of hydrocarbon recovery processes, BS&B will give accurate evaluation of wellstream potential and recommend the proper type and size of unit for maximum recovery and a quick payout.

Call your nearest BS&B representative today. Or if you want to find out more information first, write for the new brochure Bulletin 33-112. Remember the name—DRY FRAC—by BS&B!

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BS&B

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

Standard Oil Company of California, Rig LAI #173, Inglewood.

Servco Pilot Mill mills up 170′ of 5½″, 15.5#, J55 casing in 16 hours, 50 minutes!

In this Standard string, two separate sections of 7″, J55 casing, totalling 170′, were swaged to 5½″, 15.5# and run opposite independent producing zones. After cementing and testing, the swaged areas were milled out with one 6½″ Servco Pilot Mill in 16 hours, 50 minutes!

Prior to development of Servcoloy*, costly, slow-milling aluminum alloy casing would have been used in the reduced sections. Substituting steel casing resulted in important savings both in casing costs and rig time.

Use Servcoloy on your next milling job. Cutting rates possible with this unique milling material can't be matched. Your nearest Servco office will give you the full story.

*U.S. PAT. NO. 2,833,638

Steel shavings taken from the shaker prove Servcoloy efficiency.

SERVCO

General Offices: 2440 Cerritos Ave., Long Beach 6, California. **Gulf Coast and Mid-Continent:** 4850 Gasmer Street, Houston 35, Texas
Canada: 6909 104th Street, Edmonton, Alberta. **Venezuela:** Maracaibo
France: 15 Rue des Sablons, Paris. **Trinidad:** San Fernando

Field Offices: Ventura, Bakersfield, Lafayette, Harvey, Casper, Oklahoma City

tion is set for early 1960. Brown & Root Inc., Houston, has contract.

N

• **NGL Corp.** is building a 20,000-bbl. processing plant on the Sabine River, south of Orange, Tex. It will process natural-gas condensate, distillate, and natural gasoline, and will turn out 98-octane gasoline initially. Completion is tentatively scheduled for April 1961. The plant will have cat reforming and catalytic hydrogen treating.

• **Northern Natural Gas Co.** is expanding capacity of its Spearman, Tex., plant in Ochiltree County from present 100,000 M.c.f. daily capacity to 200,000 M.c.f. daily. Contractor is Dresser Engineering Co., and completion is expected by July 1960.

Pending approval before FPC is application involving proposed construction of a 50,000-M.c.f.-daily dehydration and hydrocarbon-extraction plant by Northern Natural in Glick field, Kansas.

O

• **Ohio Oil Co.** will build a plant with capacity of 25,000 M.c.f. daily to serve Scipio, Pulaski, and Albion fields in Michigan. Location is 5 miles north of Jonesville in Hillsdale County. It will use refrigeration processes to extract liquids. Initial production will be about 40,000 gal. of liquids daily, and eventual capacity will be 65,000 gal. Stearns-Roger Manufacturing Co., Denver, has contract. Completion is scheduled mid-1960.

P

• **Pan American Petroleum Corp.,** operator, and Hondo Oil & Gas Co. are building a plant at Empire Abo field, Eddy County, New Mexico, with completion expected first half of 1960. Initial compressor capacity will be 10,000 M.c.f. daily and vessel capacity 15,000 M.c.f. Recovery will be about 42,000 gal. of liquid product per day.

• **Phillips Petroleum Co.** is building a 35,000-M.c.f.-daily plant southeast of Artesia, N. M. Plant will process gas from Atoka, Dayton Abo, Empire Abo, East Millman, Artesia, Red Lake, and other fields for pipeline delivery to Phillips processing centers near Borger and Sweeny, Tex. Liquids recovery will be about 100,000 gal. per day. Completion is scheduled in fall 1960.

• **Phillips Petroleum Co.** and **Pacific Petroleums, Ltd.,** will complete an expansion program of the McMahon plant at Taylor, B. C., in 1960. Expansion will include a butane-splitter column and a deisopentanizing column, plus a 2,000-bbl. crude unit, a 700-bbl. alkylation unit, and a 1,300-bbl. fluid catalytic cracking unit. The plant currently processes 300,000 M.c.f. of gas daily. Contractor for the job is Stearns-Roger Manufacturing Co., Denver.

S

• **Shell Oil Co.** is expanding its cycling plant in Colorado County, Texas, boosting throughput from present 110 M.M.c.f. to 130 M.M.c.f. The new equipment will include absorption and refrigeration facilities permitting recovery of about 2,000 bbl. daily of additional liquid products. Completion is scheduled by the end of 1960.

The cycling plant at Little Creek, Miss., is being expanded from 4 M.M.c.f. daily to 11 M.M.c.f.

• **Skelly Oil Co.** and **Sinclair Oil & Gas Co.** will complete a new plant in Maljamar and Loco Hills field, Eddy County, New Mexico, by April 1960. Capacity will be 20 M.M.c.f. daily and recovery will be 48,000 gal. of liquids.

• **Spur Oil Co.** will rebuild the former West Gasoline Co. Hull field plant in Liberty County, Texas. The plant will be enlarged to handle 10 M.M.c.f. daily. Southwest Industries, Inc., has the contract.

• **Sunray Mid-Continent Oil Co.** is expanding its new plant in the East Criner area of McClain County, Oklahoma, from present capacity of 5,000 M.c.f. daily to 30,000 M.c.f. daily. Expected completion is July 1, 1960.

At the company's Bossier Parish, Louisiana, plant, propane-recovery facilities will be expanded, with completion scheduled July 1, 1960. Natural-gas capacity of this 60,000-M.c.f.-daily plant will not be changed.

T

• **Tidewater Oil Co.** will build a 75,000 M.c.f. per day plant in Hollywood-Houma fields, in Terrebonne Parish, Louisiana. This plant will process separator-residue gas currently produced through lease separators, using low-temperature absorption process. Recovery will be 1,030 bbl. of liquids daily. Completion is expected in late 1960. O. L. Olsen Co., Houston, is contractor on the $1.5-million project.

In New Hope-Smackover field of Franklin County, Texas, Tidewater is building a plant to process 50,000 M.c.f. of gas daily. When completed in fall of 1960, it will have capacity of more than 7,500 bbl. of liquids and 224 long tons of sulfur daily.

• **True Oil Co.** is building a plant in the Coyote Creek area of Crook County, Wyoming. The oil-absorption refrigeration system will be used.

U

• **Union Oil Co.** and **Goliad Corp.** will build a plant with capacity of 450,000 M.c.f. daily 9 miles south of Kaplan in Vermilion Parish. Liquids extraction from the absorption plant will be 295,000 gal. daily. The plant will be on lines of Transcontinental Gas and Trunkline Gas. Fluor Corp. has contract. Completion is scheduled in the fall of 1960.

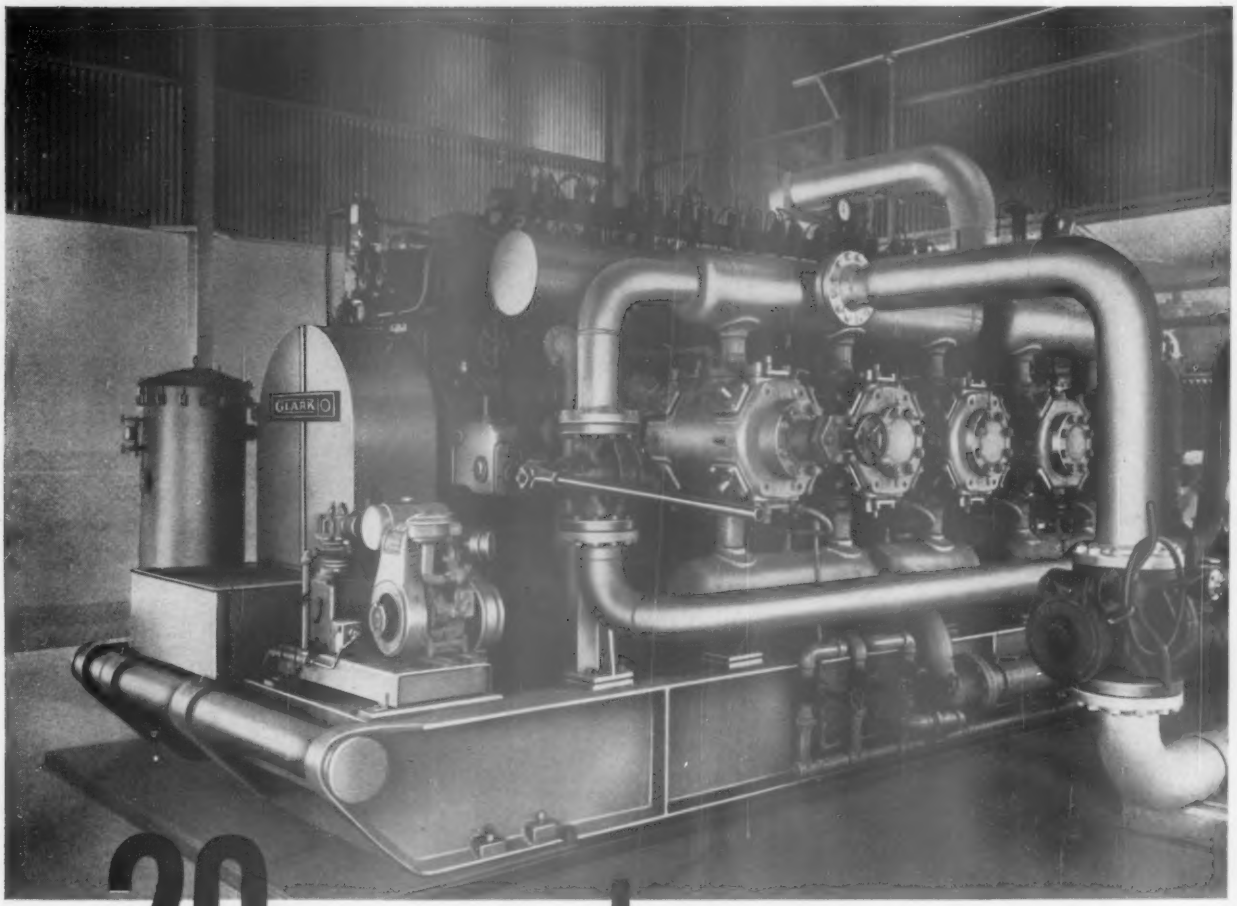
THE NEW BAIRD
field tested
ADJUSTABLE
RELIEF VALVE
for surface pumps
New style Schnorr "disc" spring assembly replaces the conventional coil spring. The ball and seat are ceramic.

Made of aluminum bronze to combat corrosion in Water Flooding, Salt Water Disposal, Hydraulic Subsurface Systems and Slush Pumps.

Two Sizes:
2" size — range from 0 to 3000#
1" size — range from 0 to 1000#

PATENT PENDING

Baird MANUFACTURING COMPANY
P. O. BOX 380 TULSA, OKLAHOMA



20% more horsepower

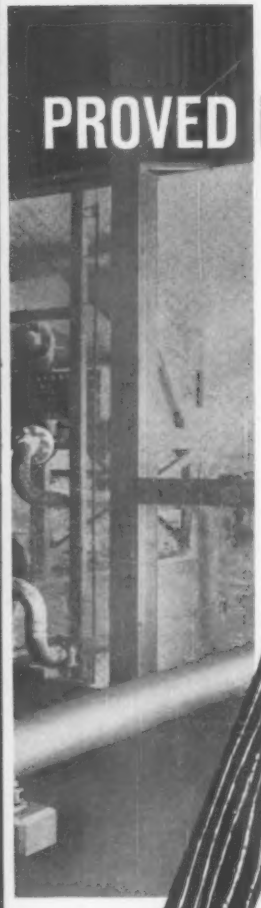
without additional power end loading achieved in CLARK turbocharged TMB compressor.

Maximum horsepower in minimum space... that's the Clark TMB packaged field compressor. A turbocharged version of the widely used HMB, the TMB, has earned a reputation as a willing, rugged, "take-charge" type of unit that owners admire and operators love. It's not fussy about the fuel it burns and never gets cranky or unruly just when you need it most – when the going is tough.

Although horsepower available for compression in the TMB is increased by 20%, no additional load is imposed upon the power end. This paradox of "more for less" is made possible by turbocharging. At rated condition the scavenging load is completely removed from the crankshaft and transferred to the turbocharger. Scavenging cylinders "work" only at start up and light loads... at all other conditions they are bypassed and float in the system.

We have put all the facts on these 400, 525 and 660 bhp compressor units into a new picture-packed brochure. Write today for your copy of Bulletin No. 157 or call your nearest Clark office for an on-the-spot report.

PROVED in the Permian Basin...



PERFORMANCE DATA

Permian Basin Pipeline Co. purchased the first TMB-10 manufactured by Clark and installed it in Lea County, New Mexico. After 18 months of highly satisfactory operation, here is a report on this first unit:

SERVICE PERFORMED - Field gathering station located at the wellhead.

ALTITUDE - 4100 feet. (Turbocharging compensates for hp loss due to elevation derating.)

PRESSURES - Suction---50# to 100#; Discharge--- 450# to 500#.

STAGES - Two-stage operation. (Can be converted to single-stage operation.)

SCAVENGING CYLINDERS - Four. One bypass cylinder.

VOLUME - Rated capacity, 4,390,000 to 5,820,000 CFD.

LOAD VARIATION - 70% to 125%.

FUEL - Untreated sour gas containing 30 grains H_2S direct from well. 1120 btu; 1.5% CO_2. (TMB can burn wide variety of field gases without detonation.)

AMBIENT TEMPERATURES - 12° to 106°.

DIRT IN GAS - Little, but considerable oil.

REDUCED SPEEDS - Operated as low as 480 rpm. with constant torque.

UNATTENDED OPERATION - Gets little attention. Unit checked only three times weekly because of protective shutdown devices.

Downtime: Negligible.

Conclusion:

TMB thoroughly proved on the job. Has great potential for variety of field applications!

CLARK

ONE OF THE DRESSER INDUSTRIES

CLARK BROS. CO. OLEAN, N.Y.

ENGINES • COMPRESSORS • GAS TURBINES

FINE PRODUCT CONTROL

is easier with a LJUNGSTROM® AIR PREHEATER

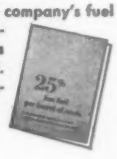
—and finer control means a more uniform, more profitable product

Income is up $58,000 a year at one East Coast refinery because Ljungstrom Air Preheater permits finer control and advanced design units. This boosts average product ratings *as much as two octane numbers.*

The most modern heat transfer system can be operated at peak efficiency with a Ljungstrom gas-to-gas regenerator. A Ljungstrom can recover as much as 1000°F heat from the exhaust of stills or boilers. Instead of letting this heat escape up the stack, the Ljungstrom returns it to the furnace combustion air.

Hotter combustion air can boost the output of a pipe still, too—by as much as 25%. Or, it can cut your fuel bill by an equal amount—or permit you to use cheaper fuels that were previously considered useless. And whatever fuel you use, there's less slag, fewer deposits, because a Ljungstrom Air Preheater helps burn fuel more completely. Some plants have "written off" the cost of their Ljungstroms *in only nine months.*

Here's documented evidence. One company's fuel savings with a Ljungstrom Air Preheater are factually described in a published magazine article by O. F. Campbell. A reprint of this case history is yours free. Simply write:



THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

The FOREMAN'S PAGE

Demonstration of pressure principles

1. Blocks were used to show relationship between weight or force and pressure.

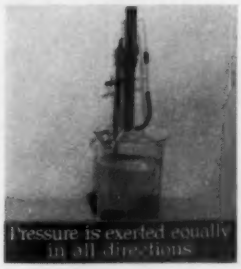
For example—the block weighs 5 lb. and is standing on end which is 4 x 5 = 20 sq. in.

$$\text{Pressure} = \frac{5 \text{ lb.}}{20 \text{ sq. in.}} = 0.25 \text{ psi.}$$

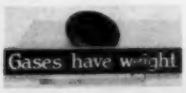
Total force = 0.25 × 20 = 5 lb.

2. Water is put into the flask and heated until it boils. A rubber stopper is then inserted in the flask, and the boiling stops. However, with continued heat, the temperature of the water continues to rise. The flask is then vented slightly until the water again boils at high temperature (about 215° F.). The flask is removed from the source of heat, stoppered, and inverted. Ice is placed in the depression in the flask and boiling again starts because there is a vacuum created above the surface of the water. Boiling in this case occurs at less than 212° F.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.



3. A manometer is tied into a funnel with tubing. The funnel has a thin rubber stretched tightly across its face. The funnel is then pushed into a beaker of water and the manometer records the pressure. At the same depth, it makes no difference in which direction the funnel is pointed; the recorded pressure is always the same.



4. These are two Magdeburg disks that fit together tightly. By placing the two disks together and evacuating the space between them, atmospheric pressure is exerted on the disks and it is impossible to pull them apart. This shows air has weight and exerts a force.

5. This experiment has two parts:

• The long flask with a squeeze bulb demonstrates that you can compress a gas. The squeeze bulb is tied into the flask with tubing. Inside the flask is a Cartesian diver. By squeezing the bulb, air is compressed in the diver, and it sinks.

• Gases occupy a certain volume under standard conditions. These are 60° F. and 14.7 psia. If the pressure is reduced, the gas will expand. This is shown by the bell jar with a balloon that is partially inflated. As pressure is reduced, the balloon grows larger. The inverted graduate is filled with water and as the pressure is removed from the surface of the water in the beaker, the water from the graduate drops.

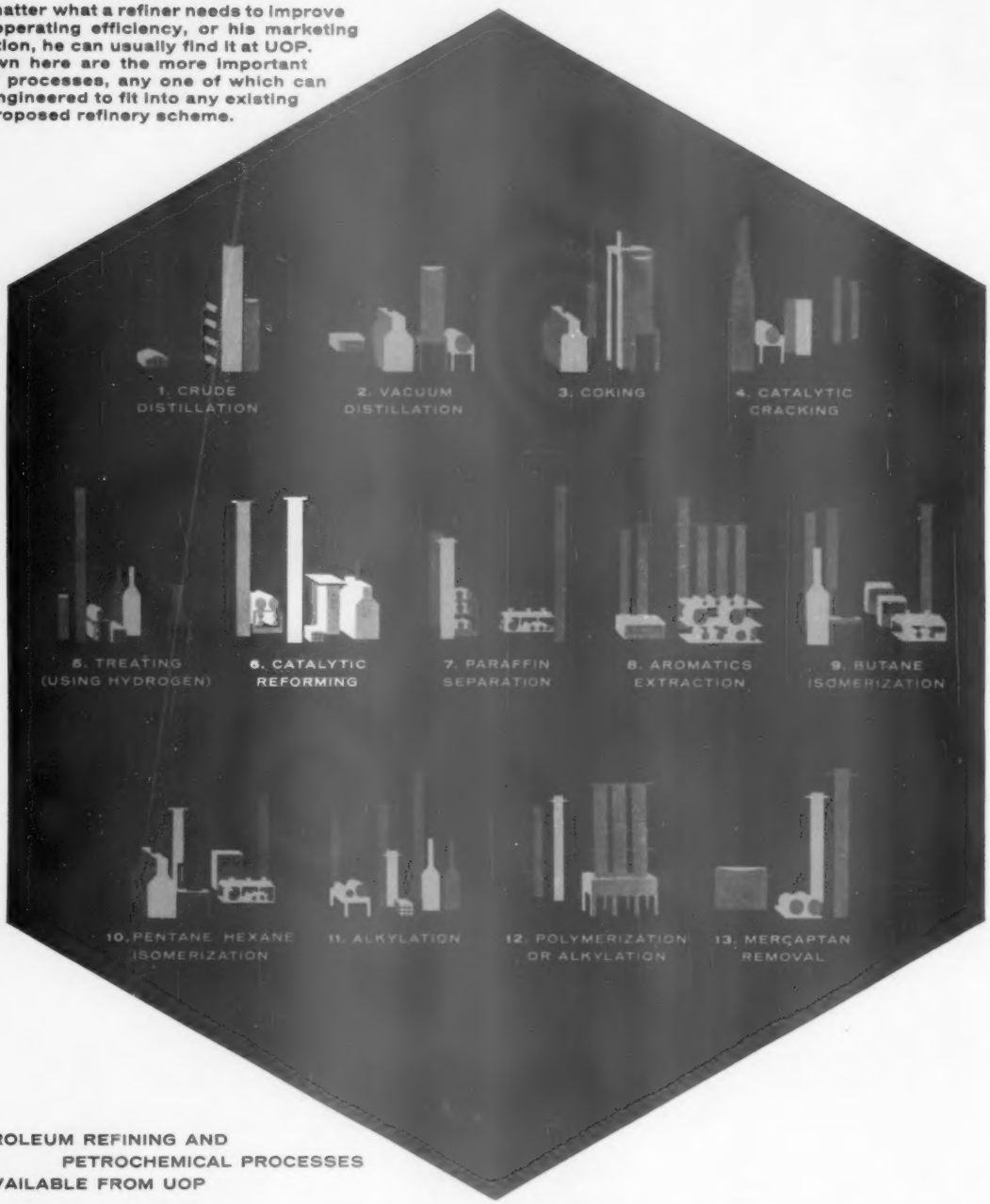
6. These are demonstrations to show how creating a vacuum in certain refinery equipment can have damaging results.

(a) Condensing vapor in an unvented vessel (not built for vacuum) will create vacuum and many times cause vessel to collapse. (Steam was condensed in unvented can.)

(b) Draining—when a tower or drum is shut down, it is necessary to drain it. When draining equipment, it is necessary that there be a vent; otherwise, a vacuum will be produced which again will collapse the equipment. (Here draining of mercury from pint can cause vacuum, and its collapse.)

(c) Pumping—this can also create a vacuum in equipment and collapse it. Vacuum pump used to collapse can.

No matter what a refiner needs to improve his operating efficiency, or his marketing position, he can usually find it at UOP. Shown here are the more important UOP processes, any one of which can be engineered to fit into any existing or proposed refinery scheme.



PETROLEUM REFINING AND PETROCHEMICAL PROCESSES AVAILABLE FROM UOP

1. CRUDE DISTILLATION equipment is designed and engineered by UOP in any desired capacity.

2. VACUUM DISTILLATION and **VISBREAKING**—easy-to-operate processes for preparation of feed stocks for catalytic cracking.

3. L.P. COKING permits adjustment of gasoline-to-heavy oils production ratio to meet market needs.

4. FLUID CATALYTIC CRACKING—an improved process that gives higher yields, higher octane numbers.

5. UNIFINING™—a modern process that completely purifies petroleum distillates.

6. PLATFORMING® produces high octane gasolines, high purity aromatics.

7. MOLEX™—a new continuous separating process that removes lowest-grade hydrocarbons from gasoline.

8. UDEX®—the ideal process for separation of super-purity aromatics.

9. BUTAMER™—a new and practical process for producing isobutane.

10. PENEX®—a new process that converts light, normal paraffins to isoparaffins.

11. HF ALKYLATION—makes alkylate, top anti-rumble motor fuel. Sulfuric acid process also available.

12. CATALYTIC CONDENSATION—converts olefin fractions of refinery gases into high-quality gasoline and petrochemicals.

13. MEROX™—a new and inexpensive treating process to remove mercaptans from gasolines and light distillates.

PROCESSES NOT ILLUSTRATED:

REXFORMING®—the ideal process to insure your top octane position.

CATALYTIC DEHYDROGENATION—removes hydrogen from hydrocarbons to produce less-saturated hydrocarbons.

HYDEAL™—a new process for the hydrodealkylation of toluene or C_8 aromatics to produce benzene; may also be used for manufacturing phenol and naphthalene.

HYDRAR™—converts benzene to cyclohexane with excellent yields, achieves extreme high purity with Udex grade benzene.

OLEFIN EXTRACTION—efficiently separates olefins and diolefins from paraffins; prepares olefins for further conversion.

AROSORB™—removes heavier aromatics from synthetic and natural distillates, produces aromatic-free heavier distillates.

ALKAR™—produces ethylbenzene, cumene and other alkylated aromatics from Fluid Cat Cracker off-gas streams.

UNISOL®—an economical process for treating high mercaptan-containing gasolines.

* '62 COULD BE THE YEAR FOR YOU!

why motorists want higher gasoline quality

Refiners right now have adequate crude capacity, but intermediate and final product processing facilities are still inadequate. Demand for higher quality in gasolines is still growing—and could put refiners in short supply within two years.

Here then, lies opportunity. Manufacturing a larger ratio of higher quality products can raise a refinery operation to new levels of profit.

What will this involve? That depends on existing process facilities, sources of crude supply, actual and potential markets, price levels and other factors.

In all of these areas Universal can provide outstanding service. UOP research and service facilities, know-how, accumulated technical and market data and specialized experience are brought to bear on every facet of the problem—*and there is a UOP process to meet any refinery need.*

Start now to determine the best way to capitalize present and future marketing opportunities.

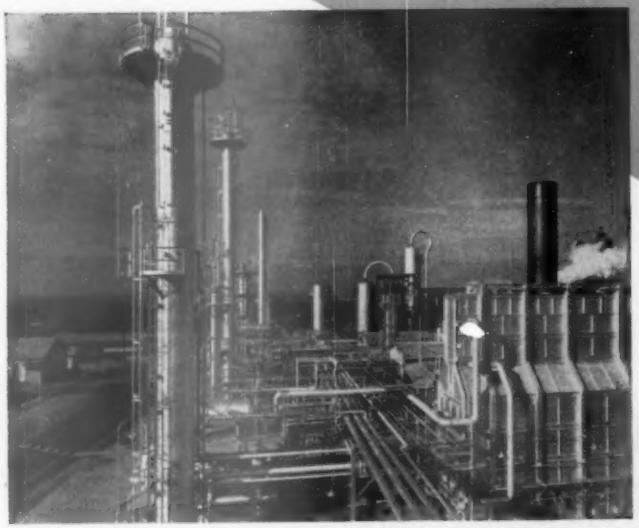
*THE CONSENSUS OF INFORMED OPINION is that 1962 will require a substantial increase in process capacity . . . NOW is the time to start your planning!

UOP

UNIVERSAL OIL PRODUCTS COMPANY

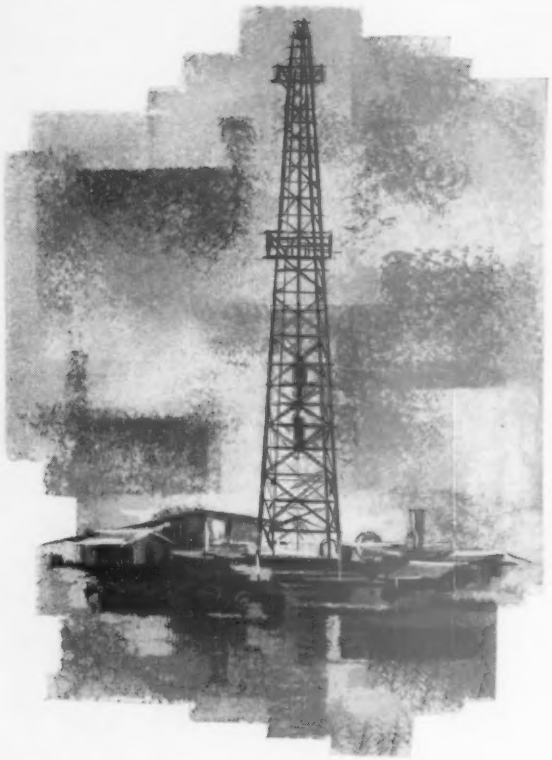
30 Algonquin Road, Des Plaines, Illinois, U. S. A.

WHERE RESEARCH TODAY MEANS PROGRESS TOMORROW



PLATFORMING®

One of the most widely used processes in the refining industry, Platforming is the practical and economical method for upgrading gasolines. Originated and developed by UOP, this process is inexpensive to install, reliable and easy to operate. The platinum-containing catalyst is highly active and hence provides truly continuous operation. Costs of periodic shutdowns are considerably reduced and initial cost is lower due to the lack of necessity for expensive regeneration equipment. Platforming can handle the full boiling range gasolines without prefractionation, or naphtha cuts separated from them. It is also highly efficient for producing aromatics such as benzene, toluene and xylenes.



New steels are born at Armco

from derricks to doll buggies . . .

Sheffield has the right bolts

Sheffield bolts are vital parts of thousands of manufactured products. They range from automobiles to zipper-making machines. From oil field rigs to toys for tots. The list is next to endless.

In all their many applications, one thing is uniformly true of every Sheffield bolt: it's the best that modern metallurgy, engineering minds and advanced machinery can produce. It's Sheffield-made and quality-controlled from furnace to finished bolt.

From one of the world's largest bolt plants, Sheffield can meet your steel bolt needs—any kind, any quantity—with top quality and quick delivery. Whether it's a standard or special bolt—or one custom-made to your specifications—you'll get the right bolt fast from Sheffield. Just get in touch with your Sheffield Man.

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Semiautomation of deethanizer

at Pan Am's South Fullerton plant results in:

- Closer control of specifications
- Safer vapor-pressure propane
- Increased revenue

SIMPLE INSTRUMENTATION costing $306.25 is expected to result in an increase in plant revenue of over $12,000 per year from tank-car sales at Pan American Petroleum Corp.'s South Fullerton gasoline plant.

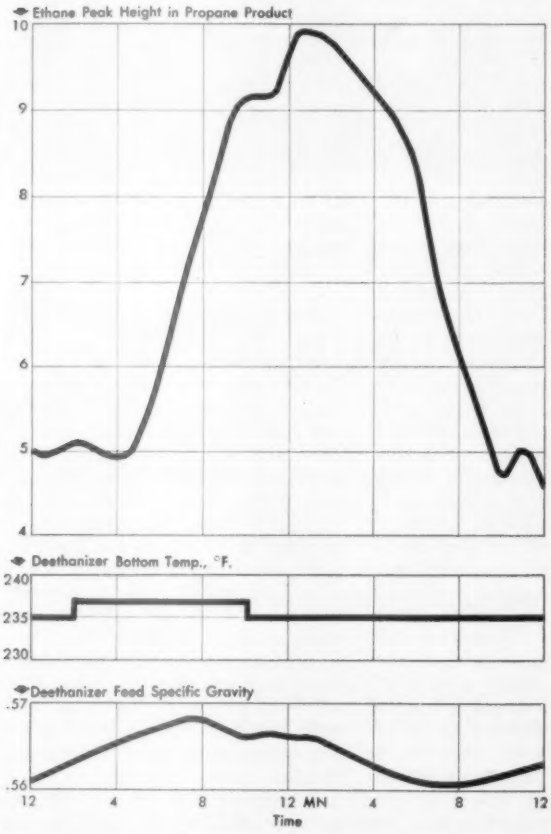
This instrumentation, installed in an existing Arcco-Anubis liquid gravitometer on the deethanizer feed stream, allows bottom temperature of a deethanizer column to be controlled by variations in the specific gravity of the feed.

Variations in vapor pressure of the plant's propane product led to an analysis of conditions around the deethanizer and the depropanizer. Analysis of the data from this study pinpointed variations in specific gravity of the deethanizer feed stream as being responsible for the vapor-pressure changes.

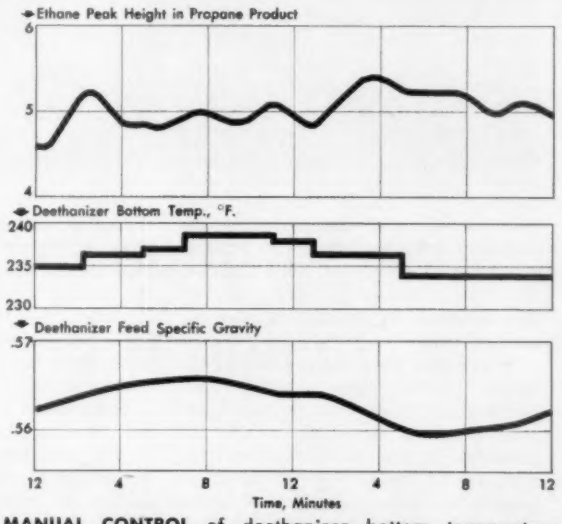
Making the study. About 3 weeks after installation of a process chromatograph at the South Fullerton plant, it was put to use in the fractionator section.

BY STEWART E. YOUNG
Pan American Petroleum Corp.

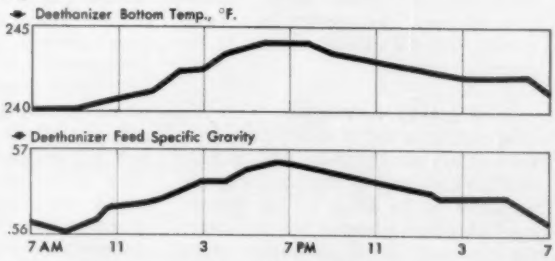
Sample lines from the deethanizer reflux accumulator tank and the propane make line were connected to the chromatograph. The instrument was so programed that a graphic representation of ethane and propane volume per cent of the propane product and propane per cent of the deethan-



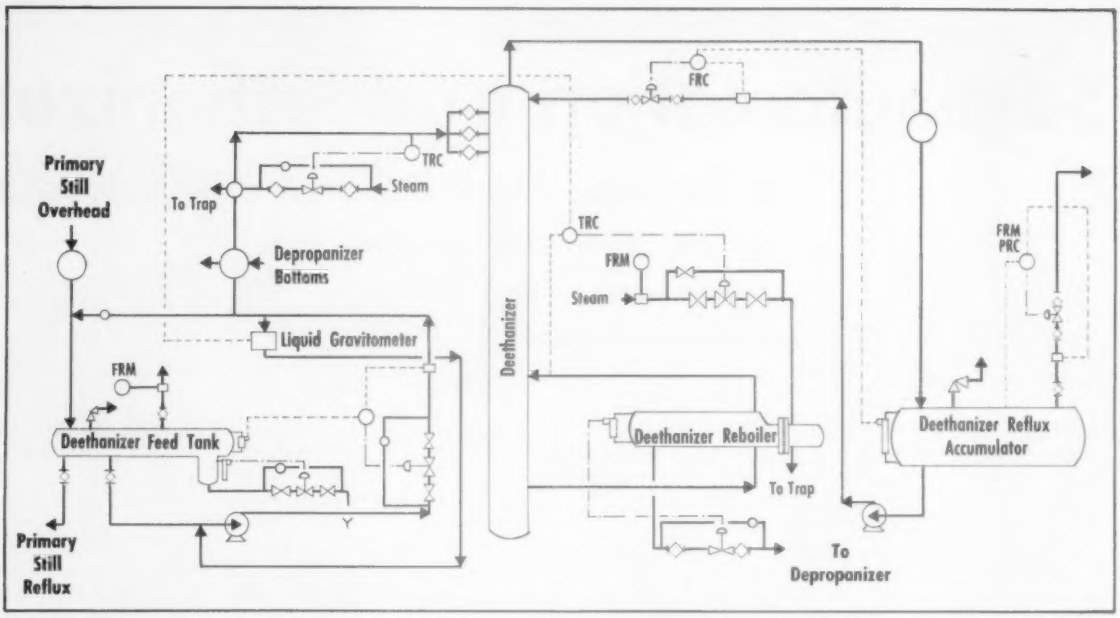
CHROMATOGRAPHIC ANALYSES show variation of ethane in product stream due to changes in specific gravity of deethanizer feed. Fig. 1.



MANUAL CONTROL of deethanizer bottom temperature based on specific gravity readings gave better control. Fig. 2.



AUTOMATIC CONTROL of deethanizer bottom temperature utilizing gravitometer to reset temperature controller produced excellent results. Fig. 3.



SIMPLE INSTRUMENTATION CHANGE on deethanizer resulted in more efficient operation and increased revenue from propane sales. Fig. 4.

izer accumulator vapors was obtained every 15 minutes.

It was apparent after the first 24 hours of operation that the ethane content of the propane product varied widely as shown in Fig. 1. Other data plotted on Fig. 1 are the deethanizer bottom temperature and the deethanizer feed gravity. Other variables around the deethanizer, such as temperature, feed rate, and pressure, were relatively constant. It was also found from the plot that changes in the deethanizer bottom temperature and deethanizer feed gravity were about 2 hours in affecting propane composition as shown by changes in mole per cent of ethane.

It had long been the practice at the South Fullerton plant to run a vapor pressure on the propane product early every morning, then make a slight adjustment in the deethanizer bottom temperature, either up or down as needed, so that a product of about 200 psi. would be made into the stock tank. Fig. 1 seemed to indicate that there was an almost direct correlation between the deethanizer feed gravity and the ethane content of the propane product.

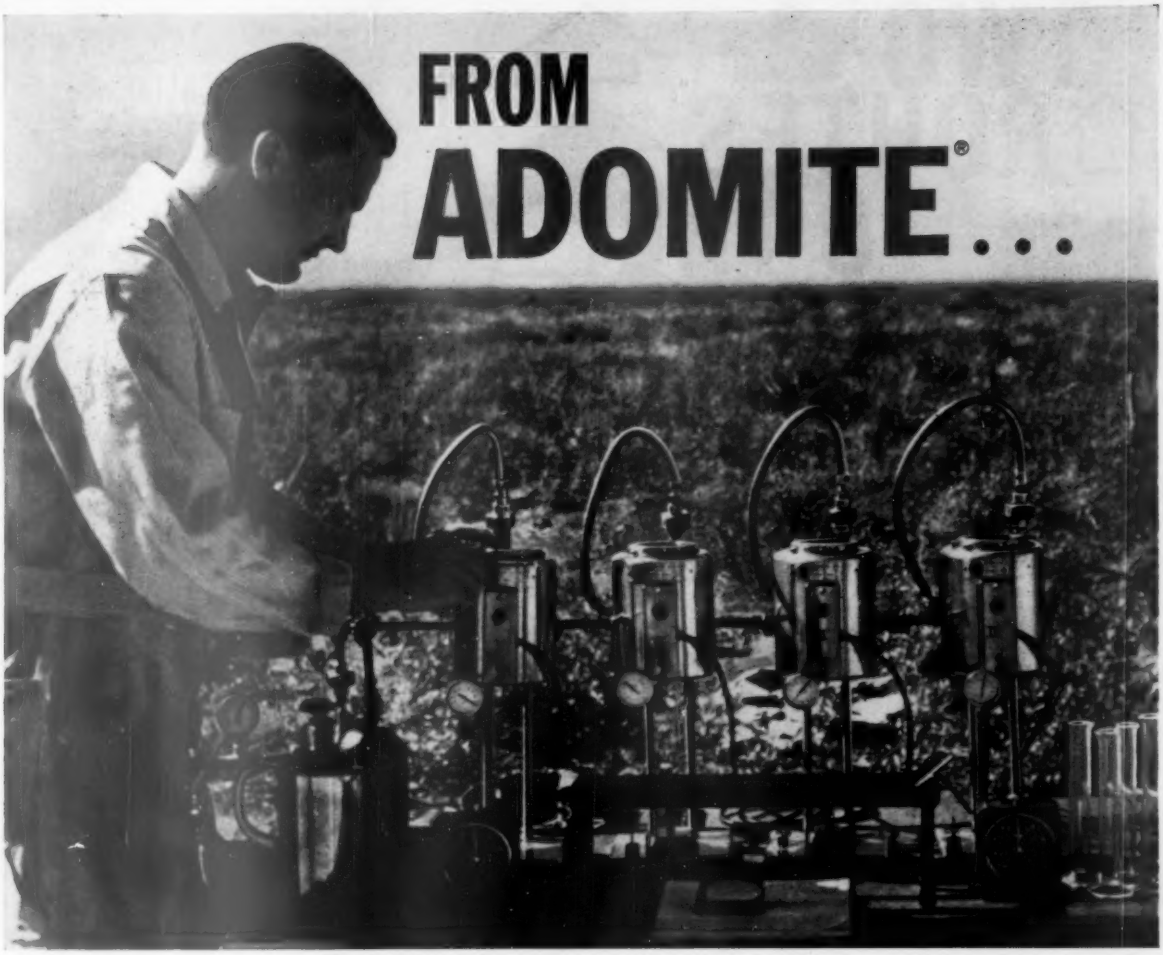
Feed gravity correlation. With this inference in mind, a table correlating deethanizer feed gravity with desired deethanizer bottom temperature was prepared to be used by the process operator. By referring to the chart, the operator could manually adjust the bottom temperature of the deethanizer as necessary. The results of such control, plotted after 24 hours' operations, are shown in Fig. 2. While the propane vapor pressure produced with this control was low, the ethane content only varied about 0.5 mole % whereas the day before the ethane content of the propane varied 3.15 mole %. Since more than one tank of propane is normally produced per day, it was obvious how, with constant bottom temperature, tanks of varying vapor pressure were being produced. Some were produced when the ethane content was high and some when it was low. After manual bottom temperature control was begun, the average vapor pressure of the next 25 tanks was 198.5 psi. The average mole per cent of ethane was 5%. Average variation of vapor pressure from 200 psi. was approximately 1%.

Since monitoring and control of the bottom temperature of the deethanizer by the operator was time consuming, consideration was given to various means of automation. After much thought, it was decided to attempt to get the desired type of control by mounting a lever on the power shaft of the gravitometer and hook this lever, through proper linkage, to a Foxboro Model 42 transmitter unit. The signal from the transmitter unit would go through an air relay which would transmit a 3-15-psi. air signal to a pneumatic-set control in the existing Foxboro M-40 controller-recorder. This instrument recorded deethanizer bottom temperature and controlled steam to the deethanizer. Formerly this instrument was manually set.

This was done for a cash outlay of only $306.25. Plant personnel have found that the whole datum plane of bottom temperature control can be changed at will by varying the length of the first link at the adjustable span pneumatic setting mechanism. The rate of change may be varied by adjusting the slope of the cam within the pneumatic set. Fig. 3 shows the fidelity with which the bottom temperature now follows changes in the deethanizer feed gravity. Fig. 4 is a schematic diagram of the present deethanizer instrumentation insofar as bottom temperature control is concerned.

Results good. Plant personnel have found this an ideal way to achieve constant-vapor-pressure propane production. Other locations which do not have a gravitometer on the deethanizer feed stream might give consideration to flowing a slip stream through a vertical tube with a differential pressure (DP) cell connected to top and bottom taps. By measuring the changes in weight of the column of fluid circulating through the column, a 3-15-psi. signal could be transmitted by means of the DP cell to a pneumatic set in a Model 40 controller.

Maintaining uniform specification vapor-pressure product enhances the safety of handling, loading, and shipping and the product quality no longer varies. If, during the past 12 months, some 19,500,000 gal. of tank-car propane deliveries by the plant had been at allowable vapor pressure, the additional volume would have increased gross revenue from these sales by about $12,000.



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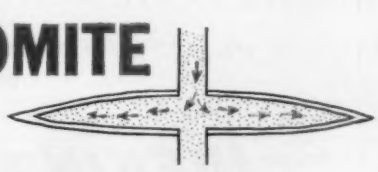

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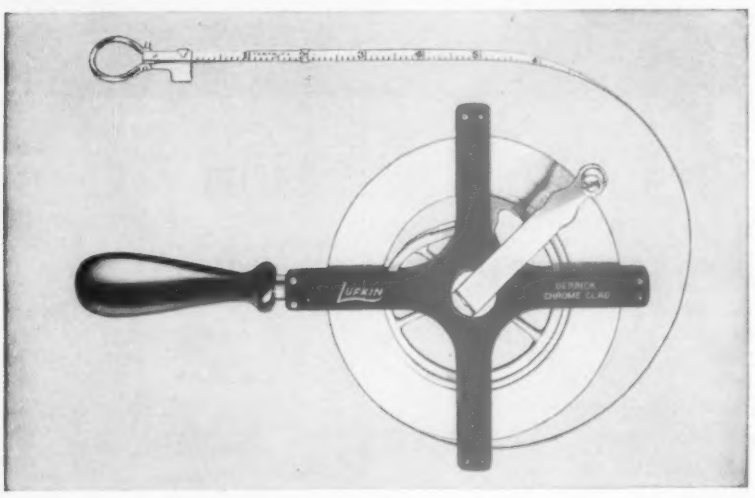

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Breathes there a man with soul so dead, who never to his friend has said, "Don't those lamebrains in the_____ Department ever get ANYTHING right? . . . I very carefully wrote EVERYTHING down, very logically and clearly . . . didn't leave a thing out . . . and they still don't get my point!" — or words to that effect?

The only qualification you need for having voiced these sentiments is that you occupy yourself daily with one or more **people**, because it is with **people** that communications break down — people on either end of the chain of communication, whether they be employee or employer, buyer or seller, veteran or newcomer. **(See Footnote)**

Whether it be an internal or external message, verbal or written, a telephone message or a memorandum, a formal report or a business letter, technical or elementary, a progress report or a comparative, scientific analysis, the ground-rules are the same for successful communications.

Take our friend who is beset by "those lamebrains," for instance. Can he be so positive that it was the **other** end of the chain that bogged down? Perhaps he was **too complete** in his instructions, where simplicity would have sufficed. Perhaps the receiver merely needed short, concise directions, not the logical, careful rationalization of the writer. Perhaps his memorandum was clear to **him**, but maybe the "practical examples" he gave weren't so practical to the recipient because it was **outside his frame of reference**, background or experience. Maybe a telephone call would have been a more efficient medium of exchange in this instance.

The basic problem, then, is one of needing to transmit our beliefs, decisions, conclusions from us to someone else, and to have that other person **understand what we mean** — quickly, accurately, simply and — pleasantly.

Perhaps one of the cardinal rules for better communications, then, is **better understanding**: consideration for others, and a **desire** to understand another's viewpoint. Actually, this merely bespeaks the real origin of "fluid communications": **thought**, for thought plays a vital role in what we feel, observe, write, say, or demonstrate; and these are the principal means of communication available to everyone: thinking, feeling, observing, writing, saying, demonstrating. **(See Footnote)**

Does this sound like a monumental, life-long task? It is, and it isn't. It is **not** monumental unless you make it so by resenting it, and it **is** life-long, because as you change, as others change, as business changes, so do communication forms, vocabularies, meanings, frames of reference.

It is not sufficient in a competitive economy to **have** convictions; it is necessary to **sell** your convictions to someone who can either do something with them, or authorize you to do so. This, then is one of the chief values of communications; to help you accomplish your aims in engineering, in your professional life, more quickly, more productively, more successfully. Combined with your technical knowledge, your ability to perform and deliver, and your initative, communications can become the most valuable tool in your professional "workshop."

FOOTNOTE: For more detailed information on this subject, write for "Fluid, Fluent Communications," to WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. BOX 1888, TULSA, OKLA. — and if there's a heat exchanger in your company's future, we'd appreciate a "line of communication" from you!

BY W. L. NELSON
Technical Editor and Petroleum Consultant

Operating costs- Catalytic Cracking

THE OPERATING costs of the common types of catalytic cracking plants are substantially the same. The airlift processes require somewhat more power but their feed preparation is less expensive and they require less catalyst.

Table 1 summarizes the operating costs of catalytic cracking units. Size is not a major factor unless extreme sizes (3,000 or 50,000 bbl. per day) are encountered. A size of 10,000 B/D was considered herein. Gas recovery and stabilization is introduced near the bottom of Table 1 as an extra or indirect cost. (See Process Costimating No. 53, Aug. 3, 1959, p. 109, and if fractionation of the light hydrocarbons is contemplated, refer to Process Costimating No. 54, Aug. 17, 1959, p. 225).

Large refinery organizations use

TABLE 2—HEAT GENERATED OR USED IN CATALYTIC CRACKING, THOUSANDS BTU PER BBL. FEED

AIRLIFT	50% Conversion	65% Conversion	75% Conversion	85% Conversion
Heating value of coke	150-165	260-290	325-355	575-610
Heat used from coke	60	58	94	83
in flue gases	90-105	202-232	231-261	492-527
Heat oil	100-172	135-214	175-302	310-492
Heat air	26-42	45-73	56-91	98-158
Outside heat required	126-214	180-287	231-393	408-650
Credit for steam generation*	35-60	45-65	90-130	130-170
Net heat requirement	91-154	135-222	141-263	278-480
Total heat generated and added	276-379	440-577	556-748	983-1260
Heat contained in steam†	45	52	97	130
FLUID				
Heating value of coke	173-190	300-334	375-410	
Heat used from coke	82	96	138	
in flue gases	91-108	204-238	237-272	
Heat oil	78-127	100-150	136-222	
Heat air	17-28	30-49	37-61	
Outside heat required	85-155	130-199	173-282	
Credit for steam generation*	45-70	50-75	110-150	
Net heat requirement	40-85	80-124	63-133	
Total heat generated and added	285-345	430-533	548-693	
Heat contained in steam†	59	67	117	

*Heat in cracked dry gases should be credited as a product. A few plants recover heat from the regenerator flue gases. †Steam used in process, not the steam generated by the process.

TABLE 1—ELEMENTS OF OPERATING COSTS—CATALYTIC CRACKING, CENTS PER BBL. (1956)

Element	Unit (somewhat standard)	1956 unit cost	Operating Cost, cts. per bbl. (1956) 50% Conversion	65% Conversion	75% Conversion	85% Conversion	See Process Costimating No.
Labor—supervision	0.5-1 men/shift*	$3.85/hr.†	0.4-0.8	0.5-0.85	0.5-0.9	0.6-0.9	26, 28, 41, 42, 44, 50
Labor—operating	4-7 men/shift*	$3.12/hr.†	3.0-4.5	3.5-5.0	3.5-5.0	3.5-5.3	
Maintenance	3-5%/yr. of replacement‡	$320-720/daily bbl.‡	3.5-5.6	3.8-6.0	4.3-6.7	4.9-7.9	29
Fuel—Airlift	91-480,000 B.t.u.§	20-40 ct./MM B.t.u.	1.8-6.2	2.7-8.8	2.8-10.5	5.6-19.2	3, 4, 6, 30
Fuel—Fluid	40-133,000 B.t.u.§	20-40 ct./MM B.t.u.	0.8-3.4	1.6-5.0	1.3-5.3		
Steam—Airlift	35-100 lb.	45-60 ct./MM lb.	1.6-2.1	1,8-2.4	3.4-4.5	4.5-6.0	8, 18
Steam—Fluid	45-90 lb.	45-60 ct./M lb.	2.0-2.7	2.2-3.0	4.0-5.4		
Cooling—Airlift	139-380,000 B.t.u.	1.7 ct./M gal.	0.9	1.0	1.5	2.6	15, 16, 38
Cooling—Fluid	124-320,000 B.t.u.	1.7 ct./M gal.	0.8	1.2	2.2		
Power	2.0-6.5 kw.-hr.‖	0.85 ct./kwh.	1.7-2.6	2.5-3.4	3.4-4.7	4.2-5.5	14, 22, 24, 25
Catalyst—Airlift	0.18 lb./bbl. circulated	8.5 ct./lb.	1.5	1.7	2.6	3.5	
Catalyst—Fluid	0.3 lb./bbl. circulated	6.8 ct./lb. (Syn. & Clay)	2.0	2.4	3.5		
Total direct cost (probable extremes)			15-19	19-24	24.30	33-43	
Obs., insurance, taxes & int., (7%/yr. of replacement)			6.1-9.8	6.5-11.0	7.5-12.3	8.6-13.8	
Laboratory overhead	0.5-1.5 men/shift*	$3.12/hr.†	0.4-1.1	0.4-1.1	0.4-1.1	0.4-1.1	26
Royalties			0-5.0	0-5.0	0.5-0	0-5.0	7
Gas-recovery plant			1.1-2.5	1.5-3.5	2.1-5.0	2.6-5.5	53
Other indirect costs			13	14	16	18	
Total cost†			28-32	33-38	40-46	51-61	

*Major refiners use more men than independent refiners.
†Average U. S. wages including 27% for all burdens.
‡Wide variation in both initial cost and maintenance between majors and independents, and also because of severity of operation.
§See Table 2. In addition, fuel may also be used for air blowers, and in a few instances heat is recovered from flue gas, Note that the heat required by recycling is included here although it also should properly be charged to feed preparation.
‖Does not include cracked gas compressors (see other Indirect Costs below).

more plant operators and their costs for investment (and maintenance) are usually larger than the costs encountered by independent refiners. This leads to the approximate ranges or variations indicated in Fig. 1 (and Table 1).

The literature reveals enormous variations in operating costs. Examination of more than 18 references shows costs (1956) as low as 22 cents per barrel and as high as 76 cents per barrel. Much of the variation arises because of differences in the severity of the operations. Conversions of 50 to 85% are considered, with recycle ratios of 0.75 and 1.3 at conversions of 75 and 85%. The airlift processes, because of the usefulness of recycling in feed preparation, can operate at 80-85% conversion but such conversions are seldom feasible with the fluid process.

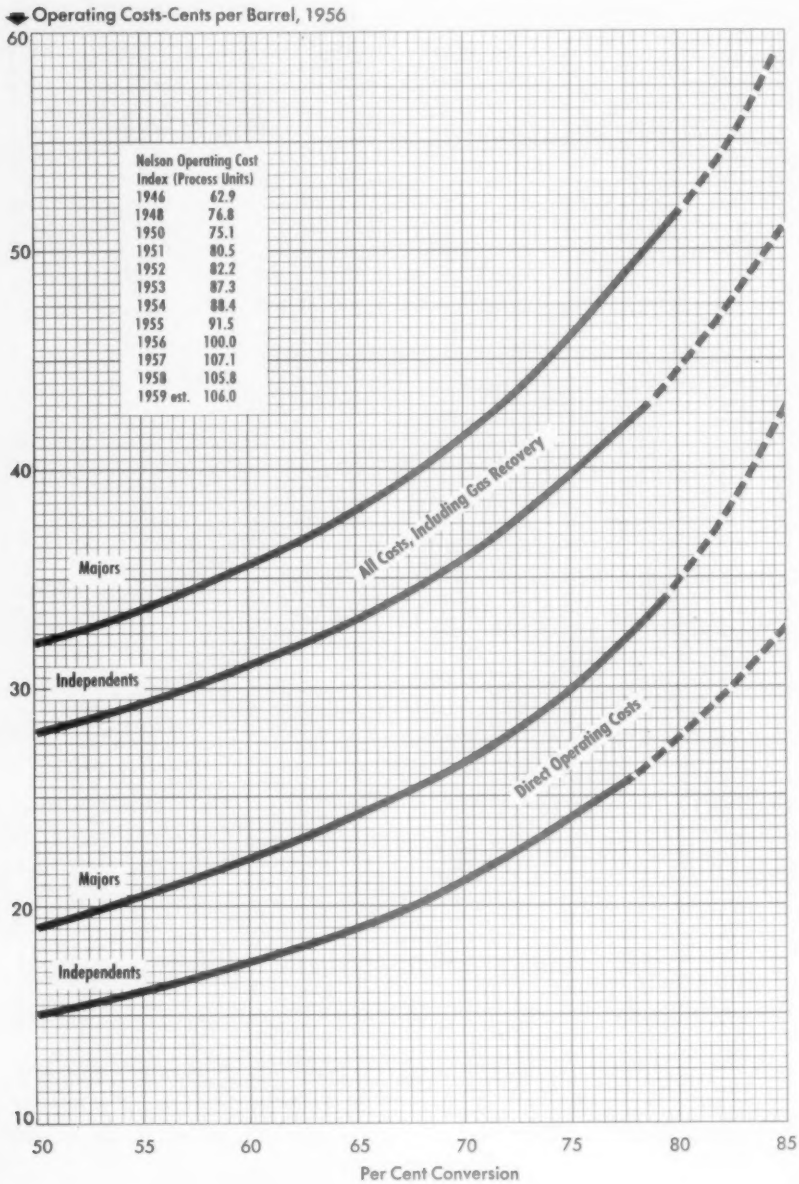
Fuel required. Much heat is generated within the cracking systems by the combustion of coke deposits on the catalyst. Most of this heat is lost in the regenerator gases, although some is useful in heating the catalyst which in turn supplies part of the sensible heat required by the feed (and recycle) and the heat of reaction. Table 2 is an attempt at clarification of the heat-balance relationships.

Heat is also needed (in most instances) for heating the feed to 600°-900° F., and to heat the air needed for regeneration. These together, heat for feed and heat for air, constitute the outside fuel requirement although the equivalent of some of this heat is usually recovered from the fractionating system by the generation of steam. Heat also enters the system by the steam used in the process. The figures of Table 2 may be used in estimating outside fuel requirements and the amount of heat that must be removed by cooling water.

Recycling requires heat, and although such heat is actually added in the feed-preparation system, it was included in Table 2 because it is a factor that properly belongs in cracking plant costs.

Catalytic cracking appears to be inexpensive compared with thermal cracking because the coke that is burned in the catalytic process is not charged as a cost. However, this is of little significance because the products recovered from the process are sufficiently valuable to justify the operation even though the feed which disappears (as coke) is assumed to have no value.

Finally, the heating values of the cracked gases are not considered as a credit here (they are a product) and any gas used for power generation must be added to the heat quantities of Table 2.



OPERATING COSTS, catalytic cracking, cents per barrel (1956). Fig. 1.

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A 1-year test shows the

Effect of detergent oils on corrosion

BY D. V. KNIEBES
Institute of Gas Technology

THE SECOND of the two 1-year test programs studying wear history of pipeline compressor engines was designed to furnish more information about the behavior of detergent oils and about engines whose oils did not follow expected patterns. A total of 60 engines was selected for the second year's program.

Group 1 engines, nondetergent oils . . . Of the 40 engines in this group, 22 required no major maintenance, and the analyses of the oils from them showed the contaminant level to be consistently low. Table 1 shows a series of lubricating-oil analyses from an engine typical of 12 engines in this group of 22. A lead-containing gasket-sealing compound is used on the inspection doors of the other 10 engines, resulting in a higher-than-normal lead content of their oils.

The remaining 18 engines in Group 1 contained oils which exceeded the normal low contaminant concentrations at some time during the test period. Table 2 presents analyses of the oil from an engine which required the replacement of four power-rod bearing liners, two power-piston heads, and eight power-piston compression rings at the time of its annual overhaul in May 1957.

The iron, copper, and lead concentrations decreased significantly after overhaul. The contaminant concentrations probably would have been reduced even further had there been an oil or an oil-filter change at that time. The oil had been in service 35,000 hours at the time of overhaul, and the oil filter had been in use for 2,600 hours. No makeup oil was added during the test period. High iron and lead concentrations in the oils of two other engines were similarly caused by excessive ring and bearing wear.

Four engines had high contaminant levels in their oils, evidently due to the detergent action of a molybdenum disulfide lubricant used on the pistons and cylinders, since analysis showed the molybdenum concentration in each oil to be proportional to the lead and iron contents. The contaminant concentrations immediately decreased to very low levels after an

From a report to the American Gas Association.

TABLE 1—SPECTROGRAPHIC ANALYSES SHOWING NORMAL OPERATION WITH NONDETERGENT OIL

Sample date—	July 10-57	Aug. 16-57	Sept. 12-57	Oct. 10-57	Nov. 11-57	Dec. 10-57	Jan. 10-58	Feb. 10-58
Neut. No.—	0.5	0.7	0.8	0.8	0.8	0.9	1.0	1.0
	Element concentration, p.p.m.							
Silicon	<1	3	5	1	1	<1	<1	1
Iron	2	2	2	1	6	2	2	1
Chromium	<1	<1	<1	<1	<1	<1	<1	<1
Aluminum	1	1	1	1	<1	<1	1	1
Copper	<1	1	<1	1	2	<1	1	1
Lead	<1	1	2	1	1	<1	1	<1
Tin	1	1	1	2	3	1	1	1

TABLE 2—RESULTS OF BEARING, RING AND PISTON HEAD REPLACEMENT

Sample date—	Apr. 12-57	May* 15-57	June 13-57	July 22-57	Aug. 14-57	Sept. 13-57	Oct. 57	Nov. 12-57	Dec. 12-57	Jan. 14-58
Neut. No.—	1.5	1.6	1.4	1.2	1.0	1.0	1.0	0.9	1.1	0.9
	Element concentration, p.p.m.									
Silicon	1	4	1	1	1	1	<1	1	2	3
Iron	14	11	10	5	6	6	1	7	8	9
Chromium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Aluminum	1	2	2	<1	<1	<1	<1	1	1	1
Copper	14	17	6	6	2	2	2	4	3	2
Lead	19	28	24	8	6	6	3	8	11	7
Tin	2	4	2	3	1	<1	1	3	2	2

*Major overhaul.

TABLE 3—SPECTROGRAPHIC ANALYSES SHOWING POSSIBLE EXCESSIVE BEARING WEAR OF SHORT DURATION

Sample date—	May 10-57	June 10-57	July 10-57	Aug. 12-57	Sept. 10-57	Oct. 10-57	Nov. 11-57	Dec. 10-57
Neut. No.—	1.6	1.1	1.3	0.8	1.1	1.2	0.9	0.8
	Element concentration, p.p.m.							
Silicon	2	10	5	3	2	3	P-1	1
Iron	4	5	5	10	6	2	4	5
Chromium	<1	<1	<1	<1	<1	<1	<1	<1
Aluminum	1	2	2	2	1	<1	<1	<1
Copper	3	3	3	5	2	3	<1	1
Lead	2	11	3	9	5	3	2	2
Tin	1	2	1	2	2	1	2	2

TABLE 4—SPECTROGRAPHIC ANALYSES OF ONE TYPE OF DETERGENT OIL

Sample date—	May 13-57	June 11-57	July 12-57	Aug. 12-57	Sept. 11-57	Oct. 15-57	Nov. 13-57	Dec. 10-57
Neut. No.—	0.7	0.7	1.0	0.2	0.6	0.5	0.5	0.6
	Element concentration, p.p.m.							
Silicon	3	1	3	5	3	2	<1	1
Iron	6	4	4	9	5	4	13	8
Chromium	<1	<1	<1	<1	<1	<1	<1	<1
Aluminum	2	1	2	1	1	1	1	1
Copper	1	2	1	2	1	1	<1	1
Lead	3	3	2	3	4	4	5	4
Tin	<1	2	1	3	1	2	2	2

oil change, and remained there for the duration of the test period.

Table 3 gives a series of lubricating-oil analyses from an engine which operated normally during the test period. The lead concentration of this oil was above normal from June through September, but since the lead content did not remain high, it must be assumed that any excessive bearing wear which may have taken place in June was not serious enough to affect normal operation of the engine.

Contaminant concentration levels in excess of those found in most normally operating engines can be due to oil-filtration equipment. An engine operated normally during the test period, but maintained 3 to 6 p.p.m. of lead in its oil until a full-flow lube-oil filter was installed in December. The February analysis showed the contaminant level to be considerably reduced. The oil used in this engine had been in service for over 25,000 hours at the time of the February sample.

Group 2 engines, detergent oils . . . No major maintenance was required on any of these engines during the test period. All seven were carried over from the first year's test, and their detergent oils behaved in the manner described previously in the results of the first test program. An example of a detergent oil having little tendency to retain contaminants in suspension is given in Table 4. The lead concentration in the oil from this engine is only slightly greater than that in a clean nondetergent oil.

Table 5 shows a series of analyses from an engine with a type of detergent oil containing silicon, iron, and aluminum in its additives. The oil also retained significant quantities of wear products in suspension.

A series of analyses was made from an engine in which the oil was changed from a detergent to a nondetergent type in August 1957. The effect of this change was principally a decrease in the neutralization number and iron concentration.

TABLE 5—SPECTROGRAPHIC ANALYSES OF DETERGENT OIL WITH SILICON AND METAL ADDITIVES

Sample date—	June 6-57	Sept. 18-57	Oct. 15-57	Nov. 13-57	Dec. 13.57	Jan. 17-58
Neut. No.—	1.1	1.0	1.2	1.2	1.0	1.2
	Element concentration, p.p.m.					
Silicon	11	12	6	7	5	5
Iron	28	27	25	21	22	28
Chromium	<1	<1	<1	<1	<1	<1
Aluminum	23	13	13	7	8	6
Copper	2	3	1	<1	1	1
Lead	15	28	17	12	14	16
Tin	2	4	2	3	2	2

TABLE 6—SPECTROGRAPHIC ANALYSES SHOWING MODERATE RING WEAR

Sample date—	July 1-57	Sept. 3-57	Oct. 1-57	Dec. 2-57	Jan. 2-58	Feb. 3-58	Feb. 28-58
Neut. No.—	1.8	1.5	1.2	1.5	1.1	1.3	0.7
	Element concentration, p.p.m.						
Silicon	7	7	10	5	5	7	10
Iron	14	30	29	21	22	14	26
Chromium	<1	<1	<1	<1	<1	<1	<1
Aluminum	6	5	4	6	6	4	9
Copper	4	2	2	2	4	2	6
Lead	4	8	8	8	5	2	2
Tin	2	2	4	2	3	1	3

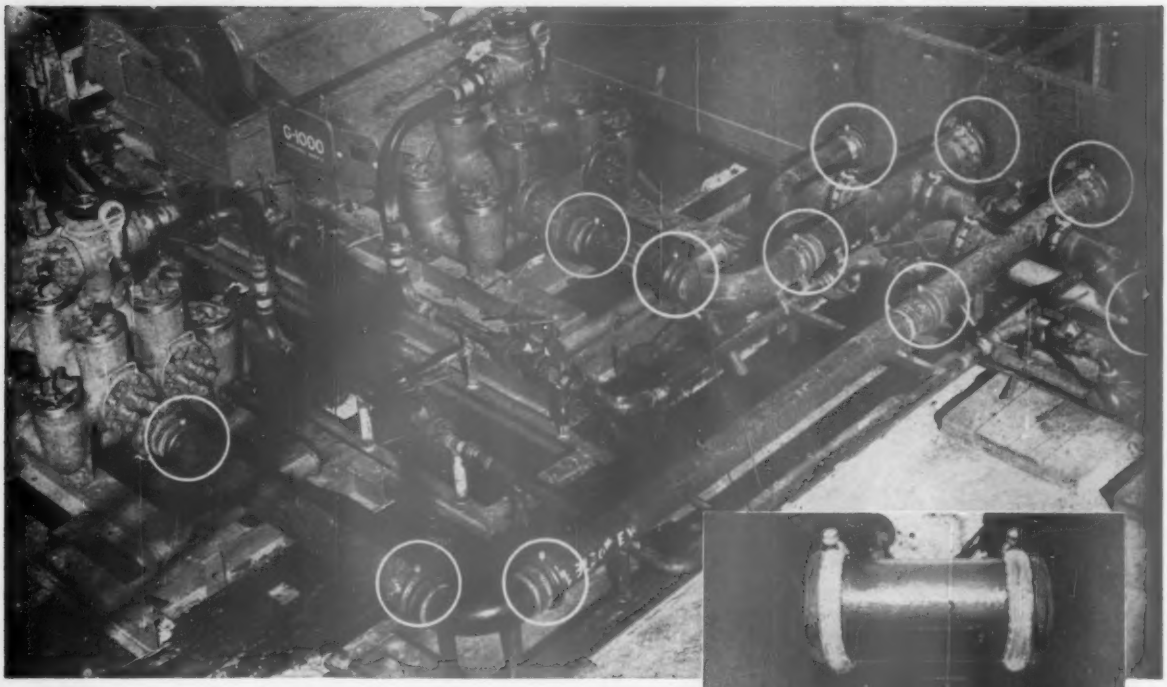
TABLE 7—SPECTROGRAPHIC ANALYSES SHOWING EXCESSIVE RING WEAR

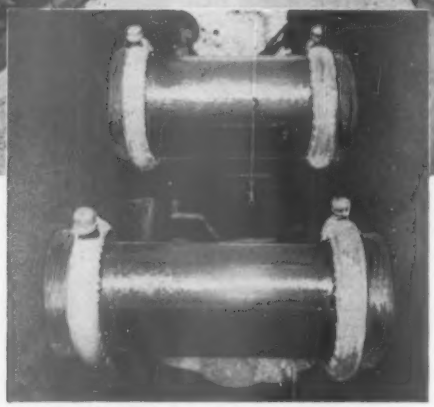
Sample date—	July 1-57	Aug. 1-57	Sept. 3-57	Oct. 1-57	Nov. 1-57	Dec. 2-57	Jan.* 2-58	Feb. 3-58	Feb. 28-58
Neut. No.—	1.5	1.2	1.2	0.8	1.0	1.0	0.8	0.9	0.7
	Element concentration, p.p.m.								
Silicon	9	18	11	8	10	6	7	9	7
Iron	40	34	43	37	46	48	54	30	23
Chromium	<1	<1	<1	<1	<1	<1	<1	<1	<1
Aluminum	9	18	5	5	10	9	9	4	8
Copper	13	16	4	3	8	6	6	2	4
Lead	4	6	10	10	7	7	5	2	2
Tin	3	6	2	4	5	3	3	2	3

*Cylinder replaced.

Natural gas producers in Texas and Louisiana are assured a stable market for their output via Transco, pipeline to the markets where the most people are.

TRANSCONTINENTAL GAS PIPE LINE CORPORATION





AIR-O-UNIONS on mud tanks and suction lines save hours of rig-up time. All you do is slip the pipe in place, inflate the tube and your suction lines are ready for service. (Inset) Installation of Air-O-Unions for compounding mud tanks.

The WECO AIR-O-UNION

PAT. PEND.

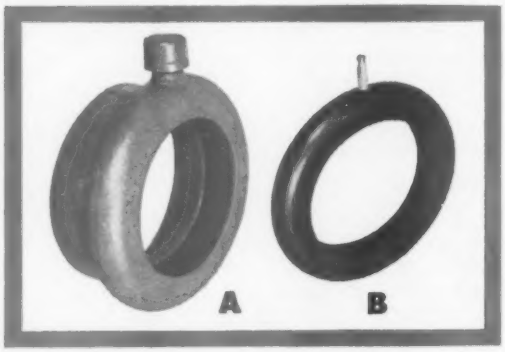
SEALS WITH A SHOT OF AIR

- **For Mud Suction and Return Lines**
- **For Low Pressure Fluid Lines**

AIR-O-UNIONS, now manufactured by WECO, are available from WECO and Chiksan representatives and supply stores throughout the world.

Air sealed Air-O-Unions give you a perfect seal on low pressure lines . . . make up fast and easy without close line-up . . . allow pipe expansion and mis-alignment without breaking the seal. No bolts, nuts, wrenches required . . . no threading or grooving is necessary . . . just use plain end pipe. Jab it through the union, inflate the tube and they're made up ready for service. To break out, just deflate the tube.

For efficient, low cost mud suction, mud return and other low pressure lines, install WECO Air-O-Unions. Ask your WECO Representative or your supply store.



AIR-O-UNIONS consist of only two parts, the union body (A) which is permanently welded in place, and the inflatable tube (B). Only replacement ever required is the tube. Sizes range from 6" to 16".

Switch to low cost, timesaving, simplified Air-O-Unions for all low pressure lines.

WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

AO-2-59

Group 3 engines, detergent oils... The six engines in this group were main-line engines at a single-compressor station. The same type of detergent lubricating oil was used in all. This oil, when new, contained small amounts of silicon, iron, and aluminum, which were determined in the analysis, and generally demonstrated good detergent properties.

During the 1957 test year, each of the engines experienced some degree of excessive ring and cylinder wear due to a number of replacement rings which had to be removed because of wear problems. These rings were different from the type normally used, and were removed from each engine as soon as possible after it was observed that they were not performing properly. The result was that the extent of excessive ring and cylinder wear differed in each engine depending on the number and length of service of this type of ring.

Although the general contaminant level of their oils was substantially higher than that of nondetergent oil, the iron content of the oil in each engine was indicative of the general amount of wear taking place. The engine which received the least amount of ring and cylinder wear had 20-30 p.p.m. of iron in its oil. Table 6 gives analyses from this engine.

The oil from the engine with the most wear contained 40-50 p.p.m. of iron, as shown in Table 7. A cylinder which had received heavy wear in this engine was replaced on January 8, 1958. The two subsequent analyses show the iron content decreasing to a normal level.

At the end of the test period, all of the poor rings had been removed, oil filters had been changed in several engines, and the iron contents of the oils had decreased significantly from their former values.

A series of four weekly lube-oil samples from four of these engines was analyzed to determine the reproducibility of sampling and analysis techniques which could be obtained with detergent oils. The results showed that an accuracy of about ±20% of each element determined could be expected. This accuracy is similar to that reported by other laboratories which use the same analytical procedure.

Group 4 engines, nondetergent oils... No major maintenance was required on any of the seven engines in this group, which were located at the same compressor station and used an identical type of nondetergent oil, and the lubricating oils remained quite free of contaminants throughout the test program.

S. E. HUEY & CO.

ENGINEERS & SURVEYORS

OUACHITA BANK BLDG.

MONROE, LA.

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PIPE LINE SURVEYS

EMPIRE SAND SAMPLE ENVELOPES

Specially designed and manufactured for storing sand samples. They will last and serve for years. Immediate delivery of any quantity.

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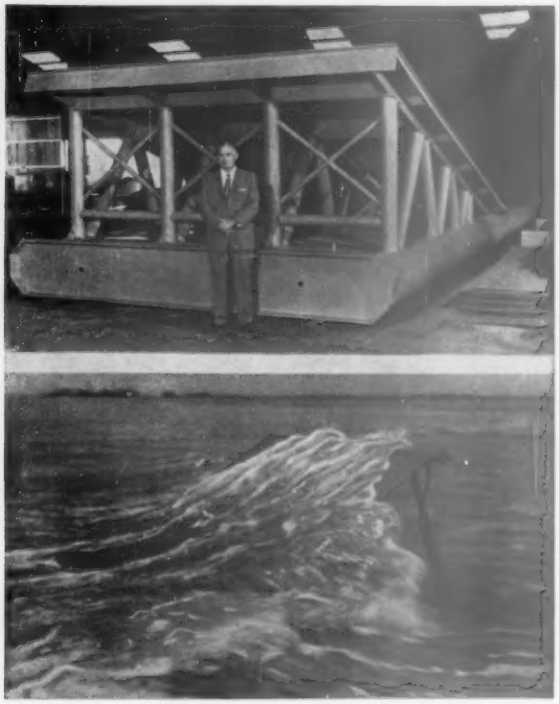
THE WORLD'S FIRST AIRLINE

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



Protection for drilling barges

. . . is offered by this sea-raft mobile prefabricated breakwater against wave impact. Currently being tested by the U. S. Army Corps of Engineers, the sea raft is a bouyant structure of large-diameter pipe which supports an inclined wall. The structure is submerged with the inclined wall set at about a 30° angle. The amount it extends above the water depends on the size of the breakwater and the water depth.

Wave water climbs the inclined wall above the normal water level to a height where the force of gravity stops it. When the wave momentum is dissipated on the wall, the water rolls back seaward. The structure is submerged by water flooding and raised by applying air pressure to the tubular structures to displace the sea water. Structures up to 300 ft. long may be fabricated to form a breakwater, the maker reports. Source: **Petroleum Instrument Co., Box 6252, Houston.**

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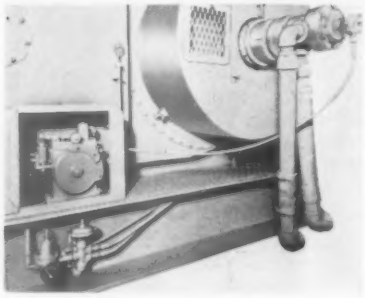

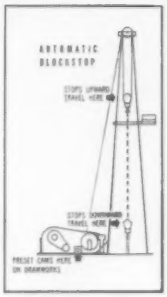

Traveling-block stop evolved

. . . that promises to provide a simple, reliable, and easily set device to stop the block both going up and coming down. It requires no parts in the derrick to operate it.

The device consists of a worm-gear reduction unit connected by a flexible-shaft drive to the drum shaft of the rig. On the worm shaft is a cam wheel on which cams are mounted. These cams can be adjustably clamped in place around the periphery of the cam wheel. The cams are arranged to contact a roller on a lever arm which will engage a valve. When opened, the valve will shut off either the high or low drum clutch and engage the drum brakes by an air cylinder so the drum will stop quickly, whether it is going up or down.

When the block reaches either the top or down position and operates the safety stop, the block cannot be moved until a release valve is pushed down and held until the roller rides

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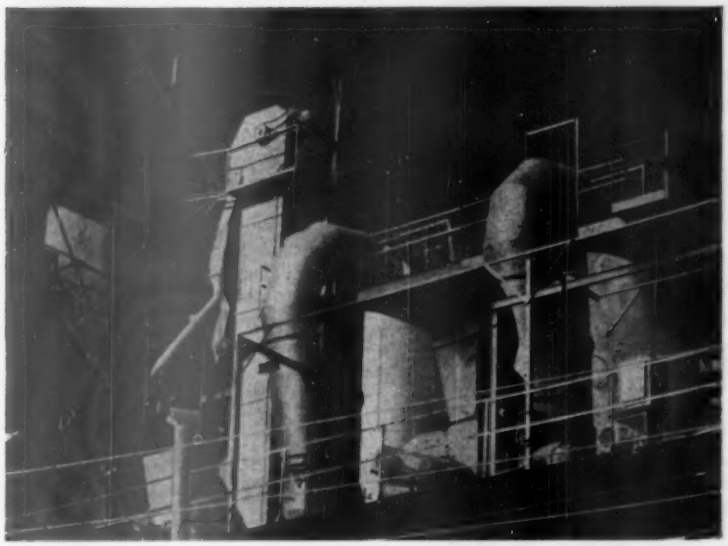
Found: A Paint that Lasts



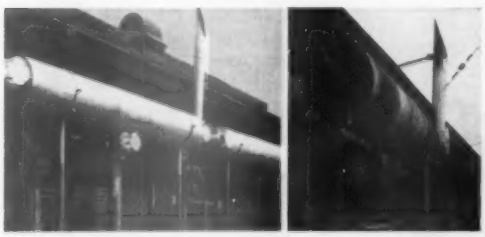
Cut Costs with New Long-Lived Silicone Finishes

You paint your plant to protect against rust and rot, but how can you protect the paint? Sun, rain, heat, sleet, smoke, and other elements of the industrial climate take a heavy toll. Shortly after the paint is completely dry, it starts to deteriorate. Soon, it must be re-applied. Thus, the cost of keeping away rust can run high: not due to the price of the coating material as much as to the repainting time involved.

Now, however, new paints based on silicone resins make it possible for you to make some really substantial cuts in paint maintenance costs. Proven to have superior durability, these silicone finishes last a good 25% to 100% longer. They keep their gloss and color and film integrity despite tough exposure to weather . . . despite high temperatures that burn or crack conventional finishes.

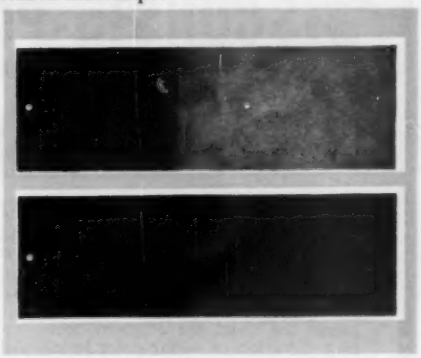
Naturally, this greater staying power means fewer repainting jobs. And that's especially important in hard-to-get-at areas of the plant, or on hot-running equipment that must be shut down for painting.

For instance, the Austin White Lime Company, of Austin, Texas, had difficulty keeping paint on the kilns and stacks shown above. Then they tried a paint based on Dow Corning Silicones, and report it ". . . by far the most satisfactory paint we have ever used." You can see the gleaming results.



Many other firms have come to the same conclusion. At left are two diesel mufflers at the Philadelphia Gas Works. Both were painted two years before these pictures were taken; one with an organic coating, the other with a silicone finish. The burned, cracked and discolored paint is the organic; the "like-new" coating is the silicone.

What if there's no heat problem, just weathering? New silicone-based coatings outlast conventional paints even where high temperatures are no problem. Look at the test panels in the photo. These panels have been exposed for one year in an industrial location where corrosive atmospheres frequently prevail. The conventional organic paint has faded, lost its gloss and chalked badly, while the silicone finish (bottom) is still in fine shape.



Colors Unlimited . . . Silicone finishes run the complete spectrum. If you want a hot-spot finish that will resist 1,000 F, certain pigments such as aluminum must be used.

But, when temperatures are not high enough to damage the pigment, you can get virtually any color you wish. This is important, for it means that, for the first time, you can carry color-coding systems over onto hot equipment without worrying about early paint failures.

Product finishes based on Dow Corning Silicones further prove the resistance to chalking, checking, fading and oxidation of these resins. For example: Sherer-Gillett, Marshall, Mich., a major producer of refrigerator display cases for supermarkets, has found a silicone-based enamel superior in durability . . . retaining high gloss after long wear . . . capable of absorbing more abuse.

Why not investigate silicone paints for your plant? Send today for the descriptive brochure, "Why Silicone-Based Paints Mean Less Maintenance." Write Dept. 2902.

Your nearest Dow Corning office is your number one source for latest information and technical service on silicones.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

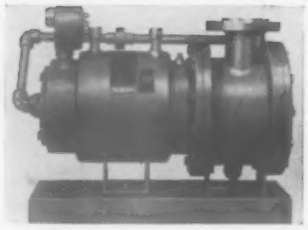
ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

off the cam wheel. When this valve is held down, the automatic stop is disconnected and the rig can be operated just as though there was no automatic stop on the rig. Source: **Wilson Mfg. Co., Box 329, Wichita Falls, Tex.**

•

Leakproof pumping

. . . at 600-ft. head is claimed for a recently announced two-stage canned pump, the Series D. The rotor, shaft, and impellers form a single rotating assembly. Both the rotor and stator are completely enclosed within corrosion-resistant, nonmagnetic alloy cylinders.



Pump fluid is circulated through the motor section to cool the motor and lubricate the bearings. No external lubrication is needed.

Because the pump and motor are built as a single unit, the pump has no stuffing boxes or mechanical seals. Leakage is thus done away with.

Pumps for operation below 400° F. are equipped with water jackets around the stator for cooling if required. Pumps for higher temperatures are equipped with external heat exchangers. The pumps can be obtained for temperatures to 850° F. and system pressures to 3,500 psi. Delivery time: 14 weeks. Price: from about $1,980 for a two-stage pump of steel construction to $3,900 for a two-stage pump of Type 316 stainless-steel construction. These include a discharge filter, Class H oil-filled motor, water jacket, and thermo-cutout. Source: **Chempump Div. of Fostoria Corp., Huntington Valley, Pa.**

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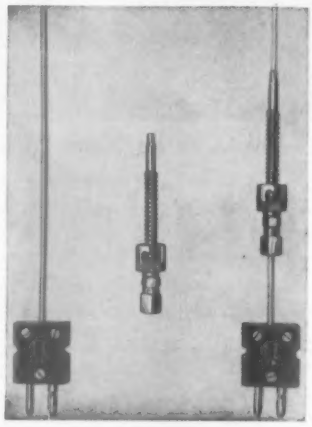

Thermocouples

. . . can be converted with a recently disclosed adapter from a tubular type to a spring-loaded bayonet type. The adapter converts a ⅛ or 1/16-in. Ceramo or other metal-sheathed tubular type thermocouples of small diameter to a spring-loaded thermocouple with an adjustable immersion length.

The adapter offers a solution to the problems caused by measuring temperatures at varying immersion depths in a system where a fixed-immersion thermocouple would be impractical.

The adapter is constructed of a stainless-steel sheath and cap, Inconel X or stainless-steel spring, nickel-plated brass compression fitting, and a brass or nylon ferrule.

The spring-loaded thermocouple compensates for expansion, contraction, and vibration by keeping the measuring junction of the thermocouple in intimate contact with the surface being measured. Delivery: immediate. List price: about $4. Source: **Thermo Electric Co., Inc., Saddle Brook, N. J.**

WISCONSIN-POWERED pump speeds filtration in disposal and water flood projects

This application typifies the adaptability of Wisconsin Engines for oil field jobs. And it proves that now you can enjoy the benefits of trouble-free air-cooled power on jobs in the higher hp range.

The Wisconsin-powered pump meets the need for efficient, low-cost filtration of water prior to injection into sub-surface formations. Used extensively in both disposal and water flood projects, the unit periodically backwashes the filter at a rate of 1160 gpm at 50 ft. tdh.

Like all Wisconsin Engines, the powerful VR4D is custom-engineered for the job. It's a heavy-duty precision-built unit in every detail. It is designed to work better and to last longer. Since it is air-cooled, you can depend on it in sub-zero cold or in 140° F. heat.

Look at the features . . . a 12-volt electric starter for fast, easy starts . . . cut-out switches that automatically protect the engine against damage due to low oil or high temperature conditions. Stellite valves and inserts and valve rotators extend valve life up to 500%.

Specify Wisconsin air-cooled Engines on your utility units. Choice of single-, two-, and V-type four-cylinder models — 3 to 56 hp. Tell us your needs and we will tailor the engine to your machine or job.

WISCONSIN MOTOR CORPORATION
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

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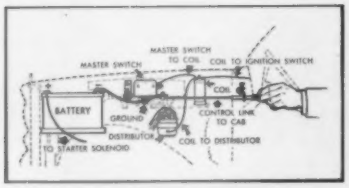
Oil Field Distributors for Wisconsin Engines and all types of Utility Units

56-HP VR4D ENGINE with clutch take-off assembly, is direct-connected through a flexible coupling to a 5 x 6-R Mission aluminum-bronze centrifugal pump.



Fire risk cut

. . . with a mechanical switch that is designed to eliminate the risk of electrical fire in parked vehicles and to lengthen battery life and reduce maintenance. The Master Switch works on the principle of eliminating battery drain which will accelerate battery deterioration and shorten its life.

It cuts the battery loose from the wiring system of the vehicle and, at the same time, grounds the ignition system, eliminating the need for the ignition key. Even with a straight-wired ignition, the maker claims equipment cannot be started while the switch is actuated, helping prevent theft. A control in the vehicle cab mechanically and remotely actuates the switch. Rated for up to 600 amp., the switch sells for about $15. Source: **Sampson Safety Products Co., Box 167, Clinton, N. C.**

●

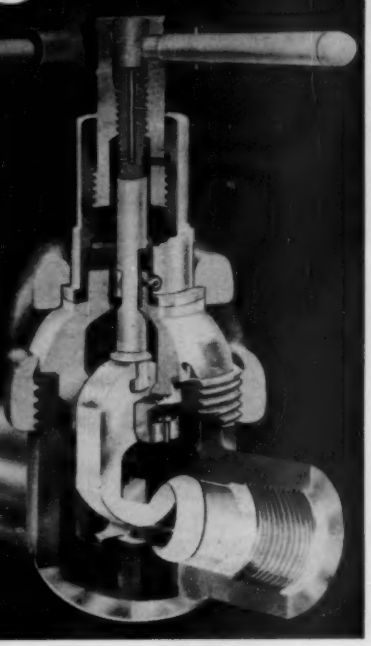
Lifting easier

. . . with a hand winch now on the market that is designed to take care of light lifting, lowering, or moving. The Model B-6 winch comes either with or without a hand brake. Drum width is 6 in. and capacity is 1 ton. Mechanical advantage is 55:1.

Cast of steel and bronze, the winches

The DEMCO

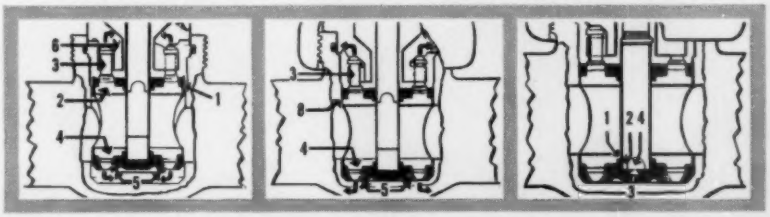
MUD KING



Seals DROP-TIGHT without "bumping"

Positive sealing under the highest line pressures—*with minimum torque*—makes the Demco MUD KING your best buy for every mud line application . . . for water flooding, hydra-frac, acidizing and cementing service . . . and for many production applications.

Demco's secret lies in its unique one-unit seal assembly, with its patented spread-ring construction. Here's how it works . . .



A. Resilient seat assembly (1) is reinforced with steel wear rings (2), having integral projecting pins at top (3) and bottom (4). In normal contracted position, the seat assembly is easily inserted in, removed from the body. Until the seat assembly is bottomed, the steel spread ring (5) does not act upon the lower projecting pins, nor do the bonnet legs (6) act upon the upper pins.

B. With the bonnet down and the seat assembly bottomed, the spread ring (5) has forced the lower projecting pins (4) outward. Similarly, the upper pins (3) have been wedged outward by the descending bonnet legs, providing a tight seal between body wall (8) and seat, preventing entrance of abrasives between seat and body wall.

C. As gate is closed, leading edge of gate slides past wear ring (1), contacts rubber ring (2) for positive rubber-to-metal seal. Seal occurs before gate touches rubber cushion (3), eliminating need for "bumping." Relief in bottom of gate (4) allows straddling of solid particles that might interfere with proper closure.

At Supply Stores Everywhere!

DRILLING EQUIPMENT MANUFACTURING CO.

Oklahoma City, Oklahoma

DRILLING EQUIPMENT MFG. CO. DEMCO OKLAHOMA CITY, OKLA. U.S.A.

engine power
BY CATERPILLAR

Repowering saves 23½% on fuel —increases production

In northwest Oklahoma, near Putnam, Calvert Drilling, Inc., plans to explore to about 12,000 feet. Drilling of the 8¾-inch hole was stopped at 9000 feet to repower rig No. 28 with three Cat G397 Natural Gas Engines. Reports Tool Pusher J. W. Nittler after change-over, "We have been averaging 200 feet of hole per day since installing the Cat Engines, which is outstanding considering present depth and formation. Besides getting the extra power we need from the Cat Engines, our fuel consumption has been reduced from 1700 gallons of butane per day to only 1300."

Switching engines in mid-hole is unusual. But the excellent performance obtained with Cat Natural Gas Engines is typical. The G397s are rated 470 HP continuous each at 1300 RPM with a 10.5:1 compression ratio. (The 7.5:1 model G397 is rated at 415 HP @ 1300 RPM.) All Cat Natural Gas Engines have Caterpillar's Low-Tension Ignition System. Far more dependable than high-tension systems, Caterpillar's design has a magneto feeding low-tension current to high-tension transformers near the spark plugs. Very short high-tension leads provide a hotter, more positive spark with less losses.

You can always convert a Cat Natural Gas Engine to diesel and back again to operate on the available fuel. And, you can select exactly the engine *you* need with Caterpillar's long line of optional equipment.

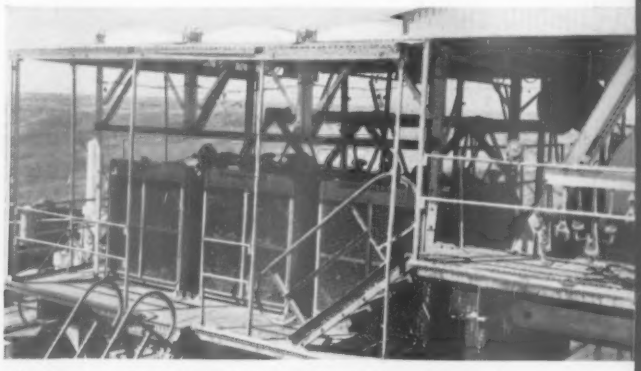
Before you install or repower oilfield equipment, investigate Cat Natural Gas Engines. Your Caterpillar Dealer will tell you everything you want to know about them. From there, it's an easy job to compare them against all others—and prove their superiority. Remember, too, to specify reliable Cat Engines when buying new equipment.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Rig has 136-foot Lee C. Moore mast. Drilling will go to estimated 12,000-foot depth averaging 200 feet per day.



▲ **Three Cat G397 Natural Gas Engines drive a compound powering draw works, rotary table, and two mud pumps.**

▼ **Engines began operation on butane, are now on field gases. They provided greater power on 23.5% less fuel.**

have two-way spring-operated holding dogs. They can be operated in either direction, or they can be placed in neutral for free spooling.

Net weight with brake is 23½ lb. Drum capacity ranges from 100 ft. for ⅜-in. line to 800 ft. with ⅛-in. line. Source: **Beebe Bros., 2724 Sixth Avenue, Seattle 4.**

●

Additives injected

. . . at 3,200 psig. with a late development in positive-displacement pumps. It's the Model CPS-4 Pulsafeeder pump. Originally designed for feedwater treatment, it gives evidence of being useful in refineries and petrochemical plants for such functions as injection of additive feed to gasoline and fuel oil, dying, and treatment of crude oil, water, and boiler water.

Equipped with a ½-in. piston, the pump is capable of pumping 9.4 gal. per hour. Delivery time: 10 days. List price: $1,500 to $2,200. Source: **Lapp Insulator Co., Inc., 108 Hall Street, Le Roy, N. Y.**

●

Flashlight battery

. . . just made known lasts 2½ times as long as older types, the maker says. The battery is sealed in steel with a steel cap and bottom plate locked to the steel jacket. According to the maker, the longer life results from chrome protection. Delivery: immediate. List price: about $0.25. Source: **Burgess Battery Co., Freeport, Ill.**

●

Threads sealed fast

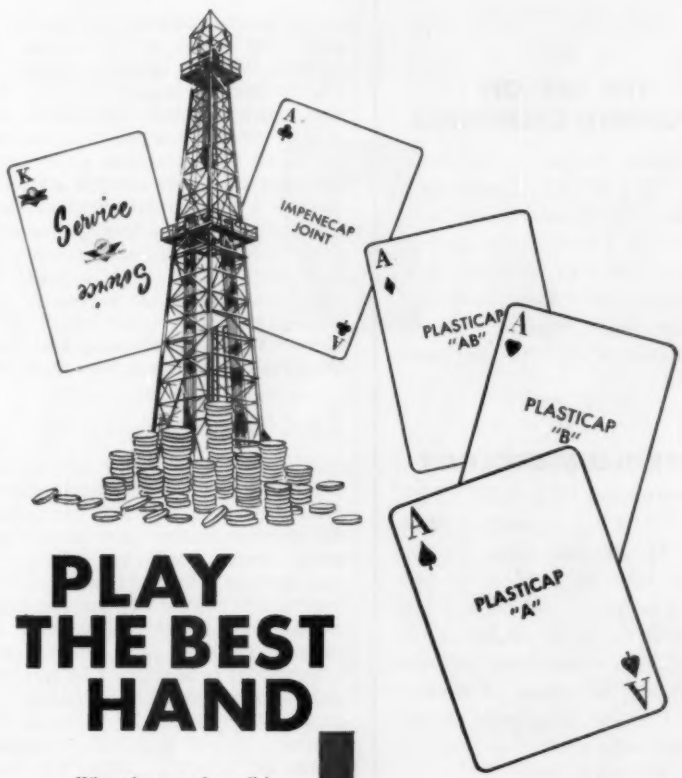
. . . with the latest in plastic tapes designed to seal and permanently lubricate threaded and coupled pipe joints, called Dry Thread Sealer No. 4212. An unfused film type of tape, it can be applied in a few seconds to pipe threads where it will conform to all

types of pipe threads and fittings in either low or high-pressure piping systems.

It looks promising for gas-meter hookups, casing, couplings, valves, and conduit in drilling, refining, and petrochemical manufacture.

Made with a TFE-fluorocarbon resin, the tape can withstand processing temperatures from the liquid-oxygen range through that of superheated steam, the maker claims. He further states that the tape is unaffected by oil traces or other lubricants in steam lines. Although nonadhesive, the tape is cohesive enough to stick to its own glossy surface as well as to pipe threads.

The tape is white, ½-in. wide, and comes in 260 and 520-in. lengths on pocket-size rolls. Price: from about $2.52 for the 260-in. length to $4.20 for the 520-in. length. Delivery: immediate. Source: **Minnesota Mining & Mfg. Co., 900 Bush Avenue, St. Paul 6.**



PLAY THE BEST HAND

When the cost of a well is at stake, there's no point in playing anything but the top cards in the deck. That means Plasticap coatings down the hole, and on the pup joints, packers, Christmas tree, mandrels, etc.— and Impenecap Joints where erosion is a problem.

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Tulsa, Oklahoma | Houma, La. | Shreveport, La. | Lafayette, La. | New Orleans, La.

Wiley BOOKS

1.

SUBSURFACE MAPPING

Preparation and Interpretation, by *MARGARET S. BISHOP, University of Houston.* Vital to the oil geologist this book stresses the new stratigraphic-type maps so valuable in oil exploration. It also explains straight to the point the various other kinds of maps that may be made to present sub-surface data, plus a discussion on how to interpret them. An immediately practical volume for the technical man. 1960. 198 pages. $5.75.

2.

THE SEA OFF SOUTHERN CALIFORNIA

A Modern Habitat of Petroleum, by *K. O. EMERY, University of Southern California.* Develops relationships among physiography, structure, water, sea life, ocean sediments—then shows their influence on origin, migration, and accumulation of oil. 1960. 366 pages. $12.50.

3.

PETROLEUM GEOLOGY

SECOND EDITION, *By KENNETH K. LANDES, University of Michigan.* Largely rewritten, the new edition takes as a theme the geological occurrence of oil and how it can be found in commercial deposits. Covers theory of evolution of oil and techniques of exploration. Includes a valuable chapter on reservoir, many case histories. 1959. 495 pages. $9.50.

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SHOWCASE . . .

New Literature

Contracting

. . . and maintenance catalog features connectors for wire splicing and terminating and sectional and 1-piece terminal blocks. In addition, it contains information on time-saving squeeze-type Romex connectors, insulated conduit bushings, knockout plugs, and cable staples. Eight-page Catalog 85 shows advantages of splice caps, snap-on nylon insulators and Termend lugs, and many wire-splicing and terminating jobs that can be done with a single hand-crimping tool. Source: **Buchanan Electrical Products Corp., Hillside, N. J.**

Control valve

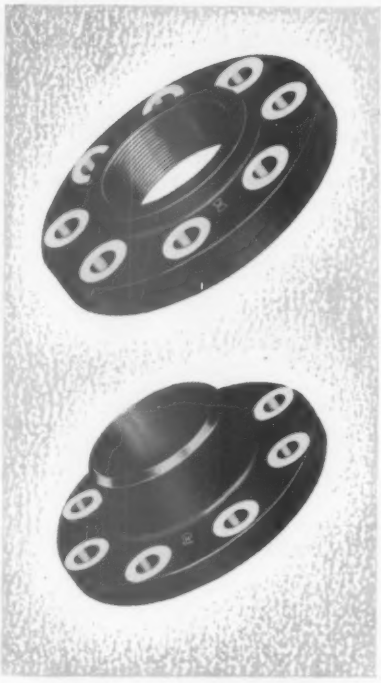
. . . for zeolite softeners, ion-exchange units, and filters is the subject of Bulletin WC-122 available presently. The bulletin (4 pages) discusses design, operation, and construction details of the cast-iron unit and the all-plastic unit for corrosive service. Among the features covered are pilot control, hydraulic-pressure actuation, and provision for no leakage and low pressure loss. Schematic drawings of flow are included as is a guide to valve construction for various corrosive and noncorrosive services. Source: **Graver Water Conditioning Co., 216 West Fourteenth Street, New York 11.**

Zinc coating

. . . called Zinkote that is self-curing, is the topic of a new 2-page literature piece. Since it is 100% inorganic, the coating protects bare steel from water, severe weathering, salt spray, and abrasion. Applied in a single coat only a few mils thick, the literature claims that Zinkote cures itself to metallic hardness and adheres permanently. It is unaffected by solvents and is not flammable, volatile, or toxic. The bulletin elaborates on the coating's general properties. Source: **Amercoat Corp., 4809 Firestone Boulevard, South Gate, Calif.**

"Canned" pumps

. . . are detailed in new 4-page Bulletin 1080 now available. The 2-stage, high-head leadproof pumps are for heads up to 600 ft., temperatures to 850° F., and pressures to 3,500 psi. The literature offers descriptions, design features, cooling-system data, special applications, and general specifications. Included are charts which present typical performance curves,



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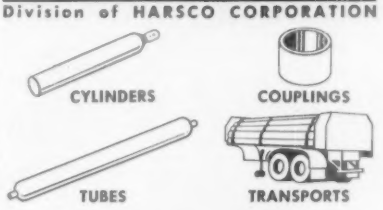

over-all dimensions, and a cross-section of the pump. Source: **Chempump Div., Fostoria Corp., P. O. Box 35-2, Huntington Valley, Pa.**

Wheel-alignment

. . . equipment for garage and service-station use is described and illustrated in a 20-page catalog just issued. Featured are Twin Post lift wheel-alignment outfits for service on passenger cars and light trucks and mechanical services on both cars and trucks. In addition, the publication covers rack-type wheel-alignment equipment with adjustable treads, as well as "on-the-floor" outfits. Catalog PL-486-5 includes descriptions and specifications of lifts, jacks, gages, service steps and stands, axle straighteners, camber correctors, and suspension calipers. Source: **Weaver Mfg. Co., 2171 South Ninth Street, Springfield, Ill.**

Telemetering system

. . . Bulletin CP 3707 describes and illustrates several types of applications of the Pulse-Code system for remote indication of liquid level, temperature, PD meters, pressure gages, control-device indicators, data gathering and reduction, and alarm and control functions. The 12-page bulletin—packed with schematic drawings—also presents system advantages, applications, specifications, and descriptive data. Source: **Vapor Recovery Systems Co., 2820 North Alameda Street, Compton, Calif.**

What's New

. . . for the Laboratory? is the title of a new 16-page publication, yours for the asking. New lab items featured include: (1) A vacuum automatic-recording balance; (2) a water-bath shaker with continuous-duty shaking mechanism; (3) laboratory glassware with Teflon stopcock plugs; (4) an extractor designed to provide a high degree of agitation; and (5) a pressure-type chromatographic column. Source: **Scientific Glass Apparatus Co., Inc., Bloomfield, N. J.**

Physical-property

. . . equivalents of cryogenic fluids are presented in tabular form on a new folding pocket card recently published. The card (Form 1341) gives: (1) critical temperatures and pressures; (2) boiling and melting points; (3) volume, mass, and thermal equivalents; and (4) conversion factors. Source: **Linde Co., Div. of Union Carbide Corp., 30 East Forty-second Street, New York 17.**

I just can't get excited
At travelling in space
To Mars, the moon or Venus
To find another race

To try to conquer unknown worlds,
To distant planets go—
I think that first we'd better learn
To run the world we know!

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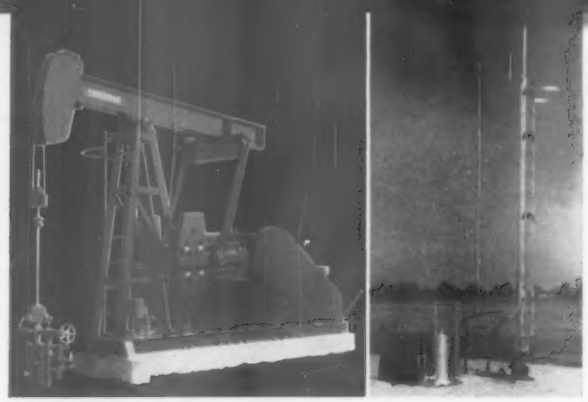

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HOUSTON, TEXAS

▶▶▶ Equipment Men Notes

William E. Hutchins becomes

W. E. Hutchins

. . . general sales manager of Tube Forgings of America, Inc., with headquarters in the Portland main office. For the past year, Hutchins has served as regional sales manager for a 7-state area with offices in Houston. He has been with Tube Forgings since the firm was formed 4 years ago.

J. J. Hansen, former sales representative for the Houston area, was selected to step up to the position of regional sales manager and will maintain the Houston office. Frank DeNina will handle inside sales in Houston.

J. J. Hansen

Earl Marrs

To meet sales growth in the Southwest region, Earl Marrs has joined the T.F.A. staff (coming from Walworth Co.) and will serve as division sales manager for Kansas and Arkansas. He will locate in Tulsa.

Robert B. MacArthur becomes

R. B. MacArthur

. . . general parts manager of General Motors Corp.'s Detroit Diesel Engine Division, reports Robert E. Hunter, general sales manager of the division. MacArthur succeeds John Ball who recently retired after 31 years of service with G-M.

MacArthur joined Detroit Diesel's parts department in 1950, later transferring to the regional field sales group. In 1958 he was appointed Detroit regional manager in charge of the division's sales and service activities in Michigan, Indiana, Ohio, and parts of Kentucky and Pennsylvania.

Powell-Duffryn, Ltd. acquires

. . . Pipeweld, Ltd., of Manchester, England. Pipeweld, Ltd., for many years has done various types of pipeline work including installations at oil refineries and at oil and chemical plants.

Happy Co. opens Dallas office

. . . and changes its sales staff.

Roy L. Rowe, former district manager of Happy's North Oklahoma sales area, will head the new office. He will also handle the Arkansas, East Texas, and North Louisiana sales areas.

Jack C. Hisaw replaces Rowe as district manager of the North Oklahoma area. He started with Happy in December 1953 as a member of the office staff.

Tuboscope Co. appoints three

Lloyd Hymel

. . . division managers, according to Ben L. Berry, Southeast zone manager. Lloyd Hymel takes over at the Harvey, La., division; Charles C. Warren, at Laurel, Miss.; and Charles (Chuck) Shake, at Houma, La.

Hymel is being transferred from Houma where he was also division manager. He has been with Tuboscope for 8 years. Warren is a former Harvey division manager. Shake is being transferred from Houston where he worked with the company for 9 years.

C. C. Warren

Charles Shake

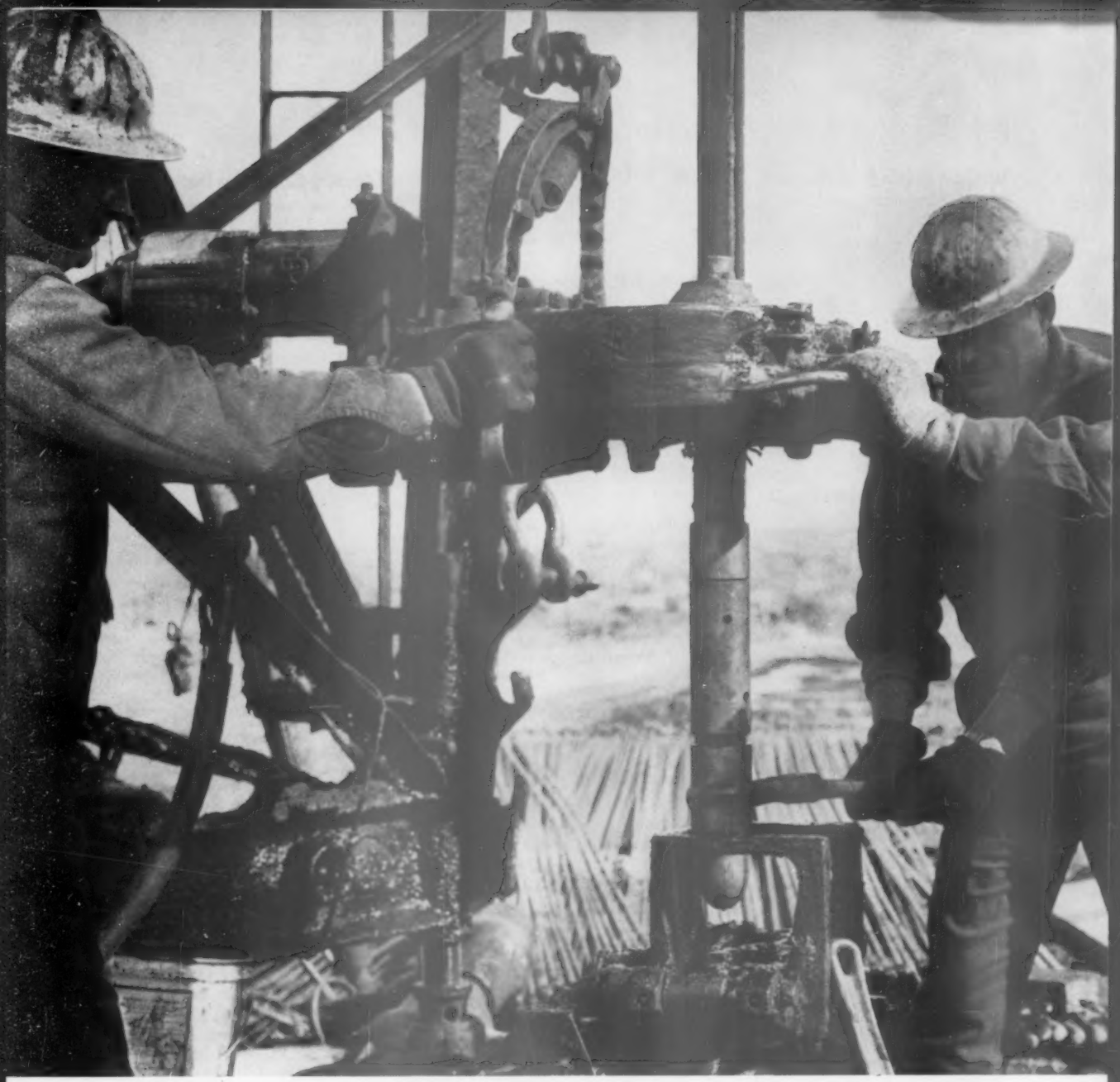
Polyken Sales Division names

. . . Midwestern Pipe Line Products Co., of Tulsa, a franchised distributor for Polyken protective tape coatings by Polyken Sales Division of Kendall Co. All Midwestern sales and service offices and warehousing facilities will be available in combination with Polyken engineering and service forces, to work with users of the pressure-sensitive tape in the solution of pipeline corrosion problems.

J. E. Charsha is sales manager

. . . of General Controls Co.'s Hammel-Dahl Division, reports J. F. (Jack) Ray, vice president in charge of sales. Charsha was formerly the division's district sales manager with offices in Wilmington, Del. He joined Hammel-

FAST WELDING of 60-ft. lengths of 30-in. natural-gas line of Trunkline Gas Co., Houston, is accomplished through use of a new International Harvester TD-15 Paywelder. C. S. LeNoir Construction Co., Austin, is laying final stages of the 57.6-mile line from Polk, Tenn., south to Brownsville, Tenn. The line parallels another 30 incher owned by Trunkline. Under good operating conditions, 10,000 to 12,000 ft. of pipe is placed every 10 hours, while rough terrain or swampy areas reduce this figure to 7,000 to 8,000 ft. Eight International crawlers including two Paywelder units, are in use.



ABRASIJET--A NEW KIND OF SERVICE THAT HELPS YOU

MAKE POOR WELLS GOOD AND GOOD WELLS BETTER

Abrasijet* is a new Dowell-developed formation cleaning and perforating service. It uses high-velocity streams of fluid and abrasive particles, usually sand (pumped through small jet orifices in the tool pictured above) to perforate casing or cut through well bore damage. Water, oil, acid and mud have been used as the sand-carrying fluid.

Reports from field after field show that Abrasijet gives better results than more conventional treatments in many instances. These same reports also show that Abrasijet has been successful in cases where all other treatments failed. Here are a few examples:

IN SOUTH TEXAS. Abrasijet was used to re-perforate a Wilcox well and penetrate beyond gyp deposited near the well bore. Production had dropped to 10 bopd on gas lift. Five sets of two perforations per level were jetted using Dowell inhibited acid and sand. *Production rose to 96 bopd with 880 psi flowing pressure.*

IN NORTHWESTERN NEW MEXICO. *Abrasijet was used to complete a 260 bopd flowing well in an area surrounded by dry holes.* Completion was into a 22-foot section of the Dakota. Abrasijet was employed to make 48 perforations in twelve settings of a four-jet tool. Well was also fractured in the basic eight-hour pump-rental time.

NEW IDEAS FROM DOWELL

TO HELP YOU MAKE MORE PROFIT

"ACID GUIDE"*

This new companion to the "Frac Guide"* is used by Dowell for *better* engineering of acid treatments. Results have been greater production increases, lower treatment costs, or both. Probable results of acid treatments can be predicted, and the most promising treatment selected for a given well.

CORROSION INHIBITOR SQUEEZE

This Dowell-developed technique for inhibiting corrosion in oil wells has given excellent long-term protection with minimum cost of application. Second and later applications of Corban* inhibitor by "squeezing" it into the producing formation have been even more efficient than the first.

FOAMING AGENT FOR WATER REMOVAL

This new Dowell addition agent can be added to water used in fracturing to induce foaming and reduce swabbing time. It is also used to facilitate air or gas drilling through low-production water zones. For air drilling, it minimizes "balling" of cuttings and creates a foam for easier water removal.

IN SASKATCHEWAN, CANADA. *A well was successfully perforated with Abrasijet after two attempts at explosive perforating had failed.* 4½-inch casing had been cemented through the Mississippian pay from 2318 to 2323 feet. Four perforations were made followed by a frac job. *One month later production was averaging 70 to 80 bopd in a field where most wells average only 50 to 60 bopd.*

IN CENTRAL KANSAS. *A well that produced only water on initial completion was recompleted successfully with Abrasijet.* A radioactive survey showed a channel from initial perforations at about 3318 feet to bottom of casing at 3405 feet. Well was squeezed with cement to shut off water. Abrasijet was used to reperforate without shattering cement. New perforations were from 3323 to 3329 feet. *After acidizing, well tested 6.5 boph with only a trace of water.*

The chances are good that you can increase your profits with Abrasijet. For prompt service or detailed information on Abrasijet, *dial Dowell.* There are 150 offices and stations in the United States, Canada, Argentina and Venezuela. Dowell, Tulsa 1, Oklahoma.

*Dowell Trademark

Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Dahl, which was purchased by General Controls 2 years ago, in 1943.

Hammel-Dahl Division produces industrial control valves and accessories. Headquarters are in Warwick, R. I. General Controls Co., with executive offices in Glendale, Calif., makes automatic controls for product and process.

H. W. Robinson is appointed

H. W. Robinson

. . . Caliornia resident sales manager of Bethlehem Steel Co.'s Supply Division by C. R. Zimmerman, division vice president. Robinson was formerly manager of stores with the Supply Division when it was affiliated with the former Bethlehem Pacific Coast Steel Corp.

His new duties involve the promotion and sales of all products manufactured and sold by the division and distributed through Howard Supply Co. Robinson will also be responsible for maintaining sales contacts with all California operators who have operations in the Mid-Continent and Rocky Mountain area and where the purchases for such operations are controlled in California.

Sales forces are consolidated

. . . at Forge & Fittings Division, H. K. Porter Co., Inc., announces Jackson Kemper, vice president and general manager. James H. Wyres has been named general sales manager of the division, heading the sales activities of W-S Fittings Works (forged-steel pipe fittings) and Cleveland Works (custom forgings and truck hardware). He was formerly sales manager of the W-S Fittings Works. To assist Wyres in specific market and product areas, four new positions have been

J. H. Wyres

J. E. Ocello

created and filled by personnel appointed from within the division.

James E. Ocello, former eastern sales manager, has been appointed manager of distributor sales. T. Bruce Cox, a sales engineer, has been named manager of new product sales. Former manager of catalog sales, E. H. Kyle, has become manager of industrial and truck hardware sales. W. H. Dresing has been made manager of commercial forging sales.

Harley Sales Co. appoints

. . . Wallace L. Reed as manager of the company's Houston branch office and warehouse. Reed is a former sales engineer for Oil Well Supply and Baash Ross Tool Co. in the Gulf Coast area.

Harley Sales Co. of Tulsa, is the oil-field distributor of Wisconsin engines and all types of portable pumping units for handling crude oil and salt-water disposal and injection.

Kobe, Inc. names M. H. Fesler

. . . as the company's western industrial sales representative, according to W. F. Slater, vice president in charge of sales. Fesler will headquarter at Kobe's main plant in Huntington Park, Calif. He will be responsible for western sales and service of high-pressure triplex plunger pumps.

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SURFACE-INTERFACIAL TENSIONS

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TENSIOMETER

Measures surface or interfacial tensions by the ring method. Precise determinations in a matter of minutes. Upward or downward forces are read directly—reproducible to within 0.05 dyne. (See ASTM D971-50)

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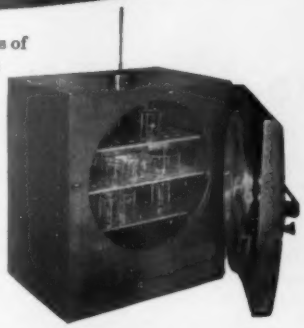

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2. Jam-Proof for safe threading by power or hand. Drive pinion kicks out automatically. Die head *Can't Jam* . . . avoids costly repairs and delay.

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MINIMUM HARDNESS

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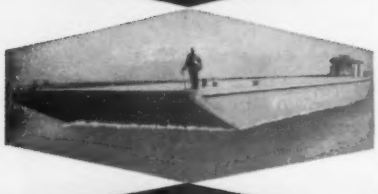

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Busy Colorado rig makes lots of hole, few repairs

A RECORD of drilling an average of 38 wells a year for more than 4 years has been established by a rig owned by the Brinkerhoff Drilling Co., Denver.

During the period, the rig completed 159 wells, for a total of 849,251 ft., or an average of 5,341 ft. Most of the wells were wildcats.

Operations are in a reasonably flat area of eastern Colorado, through about 5,000 ft. of Colorado shale and the remaining depth through various hardnesses of sandstone. Although the shale is soft, care must be taken to keep the hole clean, to avoid sloughing.

The rig is a skid-mounted National T-20, manufactured by National Supply Co., and normally considered for the 2,000 to 4,000-ft. depth range. The draw works and a National C-150-B slush pump are powered individually by GMC twin diesel engines. The skid-mounted rig includes a 7-ft. substructure and a 9-ft. Lee C. Moore mast.

Normally the rig is moved in 10 loads, consisting of the draw works with one engine, pump with one engine, substructure, three loads of 3½-in. 13.30-lb. Grade E drill pipe, two loads of doghouses and miscellaneous equipment, and the mast in two loads. For short runs, the mast can be carried as a single load.

Harry Forbes, tool pusher, says the draw works has never been to a shop and that normal replacement of roller chain and clutch elements has been the only draw-works operating expense. The brake flanges have never been replaced and still appear to have plenty of wear left.

Brinkerhoff Drilling was originally formed in Illinois in 1940, and then moved successively to the Rocky Mountain states and West Texas. The owners are Zach K. Brinkerhoff and his son, Zach K. Brinkerhoff, Jr. Another son, Robert Brinkerhoff, operates a Canadian firm, with headquarters in Calgary. The Brinkerhoffs operate nine rigs in the northwestern United States and 13 in Canada. Approximately half are National rigs, ranging from T-20's to Type 110's.

THIS RIG has been drilling wells at a breath-taking pace in the flat country of eastern Colorado.

Electricity from natural steam

The first geothermal power plant in the western hemisphere is under construction in Sonora County, California.

Having a capacity of 12,500 kilowatts, the plant to be operated by Pacific Gas & Electric Co. will be finished in April. Barnes Core Drilling Co. drilled the series of steam wells.

Two kinds of wire rope for a $850,000 rotary:
The most expensive or THE BEST.

This kind of investment precludes anything but the best. And, *anything but the best* can turn out to be the most expensive. Bargain hunting for "Economy" ropes when you lay out this kind of money is akin to putting five cent shoe laces in a pair of $40.00 shoes. Fool around with low grade ropes and you run into high grade troubles. On the other hand, a rope like Roebling Royal Blue can help protect your investment by *staying on the job.*

Here's why: Royal Blue is made from the toughest rope wire ever produced—Type 1105, Extra High-Strength Improved Plow Steel. It is a preformed rope and its resistance to abrasion, fatigue, impact, crushing and shock is very special. Thus, with Royal Blue, you're working with an extremely rugged and flexible rope . . . a rope that has 15% more catalog strength than standard rope.

When it comes to $850,000 for a Rotary, you'll do very well to have your Roebling Distributor come to you. He'll show you the difference between the most expensive rope and the *best.* You can get any further information you want from Roebling's Wire Rope Division, Trenton 2, New Jersey.

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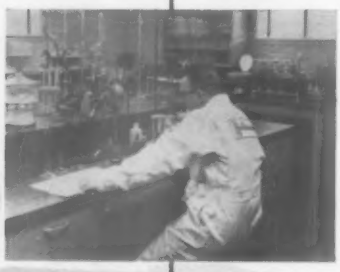

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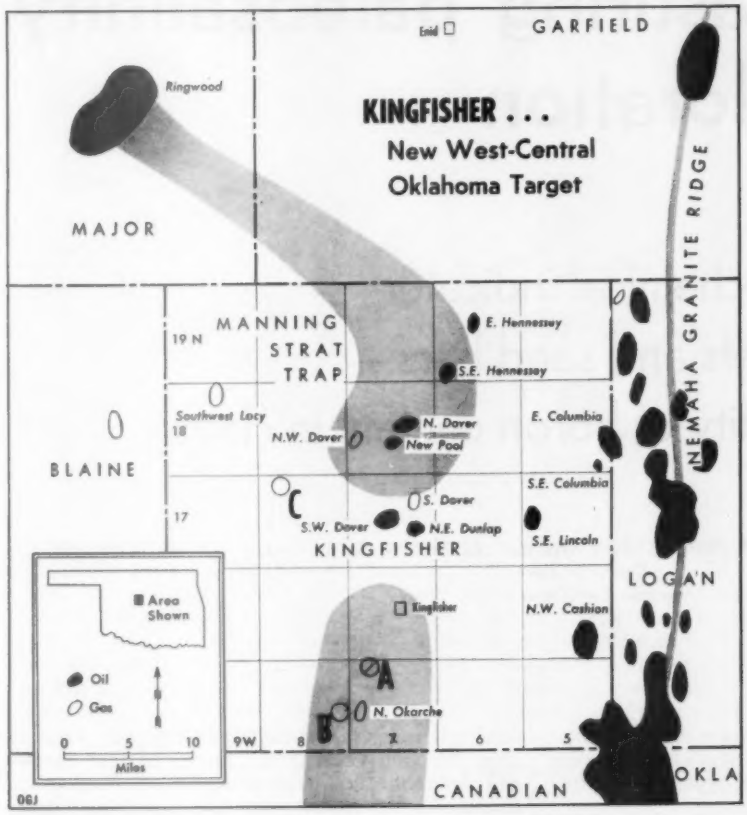


THERE IS A DEFINITE BUILDUP of exploration interest in Oklahoma's Kingfisher County . . . one of the counties bypassed in recent oil-hunting years.

Oklahoma's Kingfisher County looms as 1960 hot spot

BY JOHN C. McCASLIN

KINGFISHER COUNTY in West Central Oklahoma can be expected to take its place among the busy areas this year. The Manning of Upper Mississippian Chester age will likely become one of Oklahoma's important producing horizons as a result.

There is a growing regard for this promising pay along a stratigraphic trap that extends east from Ringwood where it was born in 1945, southeast to the Hennessey area, then south to Dover, thence jumping south to Okarche. Seven fields along the Manning trend have been opened here since 1956. More than 10 operators are busy in Kingfisher getting set for what looks like a thorough search in one of Oklahoma's least-tested counties.

From Ringwood . . . Manning is named for the Manning lease of Superior Oil Co., found in 1945 at the 41-27 Manning well at Ringwood, Major County. Its thickness is more than 170 ft. in places, consisting of limestone with shale breaks and siltstones. The upper Manning is truncated at the discovery well, while other wells to the southwest show a complete Manning zone with Chester shale on top.

Thence to Dover . . . South Dover pool was tapped in December 1956 with gas production from Manning. An expected play didn't materialize until 1958 when Northwest Dover field was discovered—a strike that set off a push which uncovered North Dover oil pool and North Okarche gas field that same year. Jones and Pellow added a third well to North Dover last year at 1 Bradbury, but North Okarche remains a one-well pool.

Both Mississippian lime and Manning production were found at East Hennessey field in 1959 by Jones & Pellow at 1 Schimanek and 1 Rickey, respectively. A new Manning hit is Apache Oil Corp.'s 1 Snow (A on map) in SE NW 5-15n-7w. A drill-stem test at 7,800 ft. yielded a high gas flow with distillate from an effective 20 ft. of pay. New work planned includes a well by Hancock at B on map in NW SE 25-15n-8w, 2 miles from North Okarche, and a reported attempt by Earl Sadler at C on map in SE NW 5-17n-8w, 7 miles west of the Dover area.

The first offset to newly opened Southeast Hennessey field is United Producing Co. 1 Clements, C NE SE 31-19n-6w. The discovery well, Calvert & King-Stevenson 1 Grimes, C NW SW 32, flowed 17 bbl. per hour on 18/64-in. choke from Manning. Texaco Inc. will drill 1 Walker in Southeast Lincoln field to Oswego. Jones & Pellow Oil Co. is testing at 1 Kudlac in East Hennessey field, the sixth producer there.

And to other targets . . . The Manning isn't the only objective in the expected frontal attack on Kingfisher County. The coming year will see more work than ever before in this county where there was no production until West Edmond lopped over the county line in 1943.

This year's work will see wildcats go to the Oswego-Pennsylvanian and the Mississippian lime as well as Manning. Average cost per well will range above $70,000. On 80-acre spacing, recoverable oil should be about 120,000 bbl. for the Oswego or Manning, and higher for the Mississippian lime. It is thought that the Manning reservoir in Kingfisher County may be over 100,000 acres.

Last year's drilling netted two new fields plus East Hennessey, and two extensions to older fields. Northeast Dunlap, an Oswego producer, was opened at Calvert-King-Stevenson 1 Perdue. King-Stevenson opened a Mississippian reservoir at 1 Wells, south of North Dover. A Mississippian well and an Oswego producer were added to Northwest Cashion and Southeast Lincoln.

The impressive acreage spread in Kingfisher County, plus last year's successes, and a lot of land to drill on will put West Central Oklahoma on the "must" list for those watching Mid-Continent oil developments in 1960.

How measuring paleosalinity aids exploration

Here is the first geochemical indicator to find barriers—reefs and sand bars—by measuring quantity of boron content in clays

BY A. F. FREDERICKSON AND R. C. REYNOLDS, JR.
Research Dept.,
Pan American Petroleum Corp., Tulsa

ONE of the most important objectives of geochemical work is to provide quantitative methods for evaluating geological processes and specifying geological environments.

One of the environmental parameters of biological and geological interest is the salinity of the sea. A method for determining paleosalinities would be not only of great academic interest, because it would provide information of use to the paleontologist, ecologist and paleogeographer, but would also be of considerable practical value in the search for various types of mineral deposits and petroleum. The purpose of this article is to summarize geochemical work, started in 1956, that was designed to determine paleosalinities quantitatively by making appropriate measurements on sedimentary rocks.

Goldschmidt and Peters[1] made the first systematic study of boron in sedimentary rocks. They noted a wide variation in the boron content of sediments and observed that a rough relationship existed between the amount of boron and the type of sediment. Later work by Landergren[4] showed that much of the boron in sediments existed in the clay-size fraction. In 1877, Dieulfait made the observation that notable amounts of boron exist in sea water (see Goldschmidt[2], p. 283). Goldschmidt and Peters also made boron determinations from sea water from different places and depths and observed a wide range of values. The observations made by these and other workers suggest that some systematic relationship exists between the boron content of sea water, the sediments formed in this water, and the salinity of the water at the time of deposition.

Relationship between boron and salinity in sea water . . . Bottom-water samples were collected and analyzed to determine the relationship between the salinity of the water and its boron content. The samples were obtained from various shallow-water environments along the Gulf Coast in the vicinity of Port Lavaca and Rockport, Tex. The salinity of the water was measured by determining the density with an immersion hydrometer, correcting for temperature, and referring to curves relating density to salinity (see Harvey[3], p. 128). The samples were stored in polyethylene bottles to avoid contamination of the water from boron normally found in glass bottles.

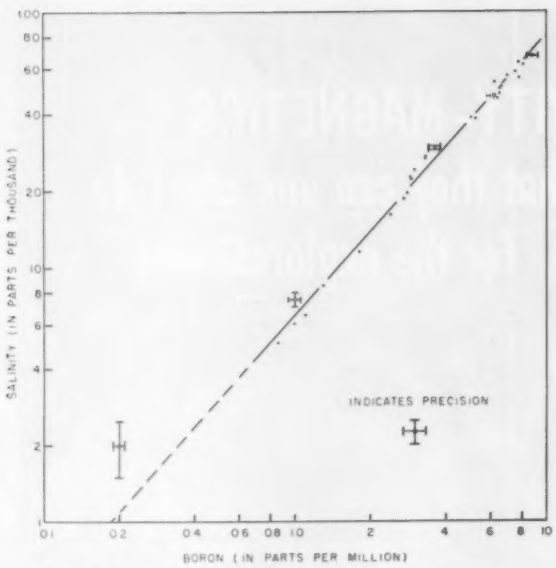
An attempt was made to secure samples from as many environments as possible. Samples were taken from the surf zone, shallow bays, euxinic bayous, rivers, and evaporating tidal flats.

The boron content of the samples was determined by emission spectrographic methods. A soluble beryllium salt was used as an internal standard. The samples were analyzed using a high-voltage spark and rotating disk electrodes. Details of the spectrographic technique will be reported elsewhere.

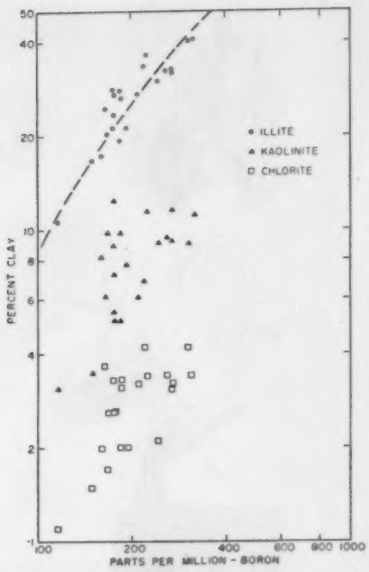
Occurrence of boron in sedimentary rocks . . . Boron analyses reported here were made using an emission spectrochemical technique adapted from Melvin and O'Connor[6]. The powdered sample was mixed with beryl and graphite and arced to completion in a high-current d.c. arc. Beryllium was used as the internal standard. The equipment used was the same as that used for the sea water analyses. This technique will be reported also in detail elsewhere.

Illite contents were determined by measuring, with x-ray fluorescence techniques, the potassium content of purified clay. This method was used when x-ray diffraction studies indicated the absence of other potassium minerals in the samples.

The earlier work by Landergren and others indicated that the higher concentrations of boron in sediments occurred in argillaceous sediments. It was suspected, therefore, that the boron was contained in the clay mineral fraction of the sediment. Boron also oc-



A RELATIONSHIP exists between boron content and salinity of Gulf of Mexico bottom waters. Fig. 1.



CARDIUM SHALES have a relationship between clay and boron. Fig. 2.

curs in tourmaline in sediments. On all the work reported here, however, all the material was carefully sized and it is believed that essentially all tourmaline was removed from the samples. Also, other chemical treatments of the samples indicated the absence of tourmaline in the clay-size fraction.

Results

The boron content of the water samples is listed in Table 1 and shown in Fig. 1.

Location of boron in shale . . . The amount of boron in some shale samples is plotted against the amounts of kaolinite, illite, and chlorite (Fig. 2). The shale samples were taken from a core of the Cretaceous-Cardium formation of Alberta. The relative abundances of the clay minerals were estimated by measuring peak areas from X-ray diffractograms prepared from glycol-wet powdered shale that was packed and smoothed into a rectangular sample holder. Fig. 3 shows the progressive change in diffraction pattern of Cretaceous-Mesaverde shale in New Mexico from which clay minerals other than illite were removed by chemical treatment. The potassium and boron contents of this sample before and after treatment are indicated in Table 2 along with potassium and boron data for other shales that were treated in similar fashion.

Boron content of illites from other shales . . . A large number of cores and outcrop samples were collected from areas where other geological work has indicated the geological environment to represent fresh-water, brackish-water, normal marine, or hypersaline conditions. These qualitative environmental evaluations were made by reference to the literature together with noting such details as the texture of the rock, its fossil, coal, or organic content, and its general geological setting. The results of the boron measurement of the illite frac-

TABLE I—RESULTS OF THE SPECTROCHEMICAL ANALYSES OF BORON IN GULF COAST BOTTOM WATERS

Specimen Number	Total Dissolved Solids (Salinity) in Parts per Thousand	Boron Content p.p.m.	Environment
1	46.5	6.0	Shallow bay not over 6 ft. deep, well aerated.
2	46.0	6.4	
3	46.0	6.2	
4	46.5	5.8	
5	46.5	6.2	
6	48.0	6.5	
7	6.0	1.0	Bayou, euxinic environment
8	5.0	0.86	
9	8.5	1.3	
10	7.5	1.0	
11	6.5	1.1	
12	38.5	5.0	
13	26.5	3.3	
14	29.0	3.6	
15	27.0	3.3	
16	21.0	3.0	
17	22.5	2.8	
18	50.0	6.5	Shallow bay grading to euxinic bayou
19	51.0	6.6	
20	53.0	6.2	
21	56.0	7.0	
22	55.0	7.8	
23	58.0	7.5	
24	62.0	8.1	
25	63.5	7.8	
26	67.5	8.8	
27	270.0 (saturated)	88.0	Tidal pool; salt bottom
28	2.0	0.20	Colo. River 10 miles from coast
29	22.0	2.9	Euxinic Bayou
30	19.5	2.8	
31	18.5	2.7	
32	16.0	2.4	
33	11.5	1.8	
Gulf Water	38.0	5.2	Surf zone of the open Gulf of Mexico

"Dog-eared" is a term sometimes applied to gravity and magnetics as exploration tools, but these "old guard" methods of exploration can teach many of us new tricks about getting certain prospects surveyed quickly, efficiently and economically.

A number of tails began wagging after explorationists stood up on their hind legs and took a new sniff at prospects via the gravity-magnetics route.

If you are interested in cutting costs, while answering specific geologic questions, give us a whistle and we'll trot out our new Bulletin GM59-1, **"Gravity-Magnetics . . . what they *can* and *can't* do for the explorationist."**

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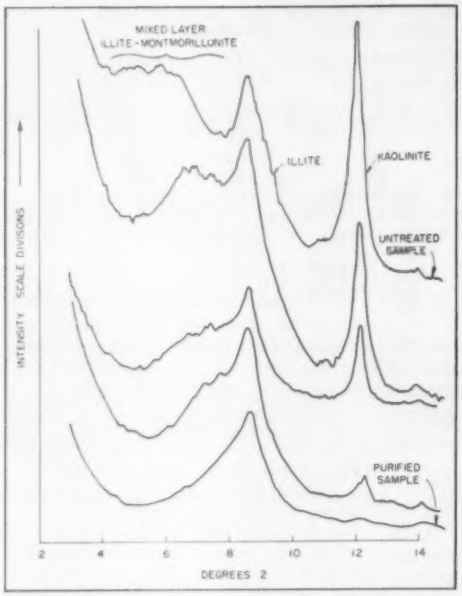
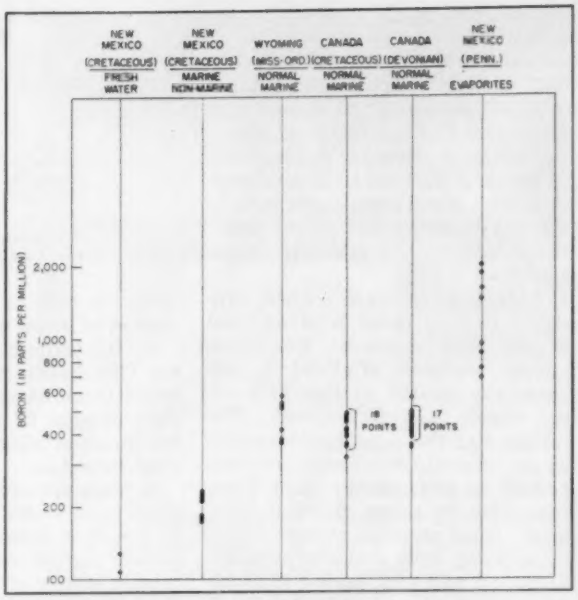


X-RAY PATTERNS show the progressive removal of clays from illite by chemical treatment. Fig. 3.



BORON CONTENT of purified illites is charted from rocks of known geological environments. Fig. 4.

tion from these rocks are shown (Fig. 4). Boron concentrations refer to p.p.m. B in pure illite; this "normalized" boron content was calculated according to the following expression: p.p.m. B × 100/% illite = p.p.m. B in pure illite.

Discussion of Results

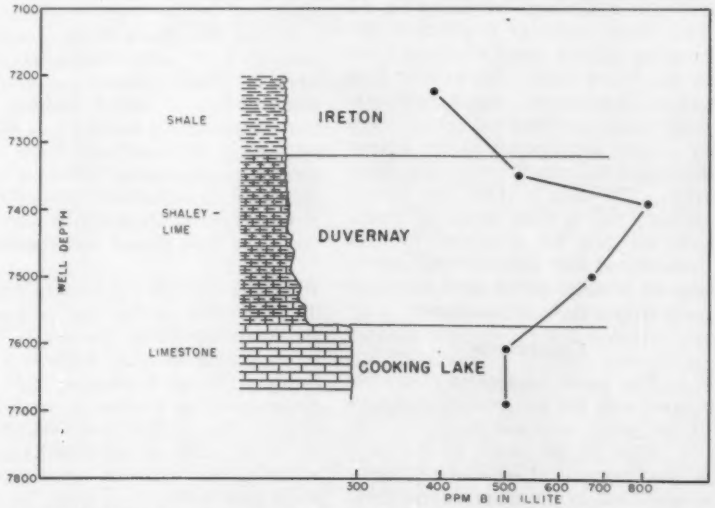
Boron and salinity . . . As shown in Fig. 1, a linear relationship exists between boron and salinity in the Gulf of Mexico bottom waters from fresh water to brines containing 70 parts per 1,000 salt. The relationship for more concentrated brines is being determined and no data are yet available. It appears probably that with increases in salinity, the boron content of the brine will also increase. The exact relationship can only be determined by experiment.

Extraction of boron from sea water by clay minerals . . . Fig. 4 can be interpreted to indicate that illites extract boron from sea water in proportion to the amount present. The exact form of the absorption isotherm or extraction curve is not known at the present time and must be determined experimentally. Synthesis experiments to clarify this point are under way and will be reported at a later date. It is also not known whether the boron enters a previously existing clay mineral structure (a "stripped" mica, or other detrital mica of some kind) or is incorporated into an illite formed directly from gels and other constituents present on the sea floor and in the sea water. To date, the evidence gives information only on the chemistry of the clay minerals and no direct information on how the clay minerals formed.

Location of boron in the Cardium shale . . . Fig. 2 illustrates that a linear relationship exists between illite, kaolinite and chlorite in the Cardium shales tested. In these and many other rocks tested, illite and chlorite occur in approximately a fixed ratio, which varies from area to area, irrespective of the total amount of material in the clay mineral fractions of the rocks. The best relationship occurs between illite and boron. These data have been interpreted as indicating that the boron in the Cardium shales is associated with either mica or illite, both of which are characterized by a 10° A diffraction peak.

Analyses of micas from other rocks showed boron to be present in very low concentrations. Goldschmidt[2] (p. 282) has found micas to contain less than two p.p.m. B, therefore, there is good evidence that the bulk of the boron in the Cardium shales is associated with the clay mineral illite. To test this hpothesis, the clay-size fractions of several shales were treated chemically in such a way that non-illitic clays were selectively removed. The diffraction patterns of one of these can be seen in Fig. 3 and their boron content noted from Table 2.

For all samples except one, the in-



PALEOSALINITY CURVE for some Devonian rocks in Canada is shown. Fig. 5.

creased percentage of illite in the clay-mineral fraction resulted in an increase in boron content. The one that remained unchanged (shale 5) originally contained almost pure illite in the clay fraction. Thus the chemical treatment resulted in essentially no change in illite and hence no change in boron. These experiments indicate that the boron content of the shales tested is contained primarily in the clay-mineral illite.

Additional chemical studies have shown that the boron is firmly fixed in the illite structure. One shale sample, (shale 5) of Table 2, was chemically treated so that 85% of the sample was decomposed. The residue had the same boron content as the original. Apparently it is not possible to preferentially leach boron from illite by severe chemical treatment. Other chemical attempts to remove boron from shales have failed. Treatment with acid, heating to incandescence, anion and cation exchange experiments, and treatment with alkalis have been tried on about 25 shale samples. Significant amounts of boron were not lost from any samples. The conclusion reached is that the boron, once it is fixed into the illite lattice, stays there in substantially the same quantities when the sediment is subjected to other processes normally occurring in sedimentary rocks.

Boron content in illites from other shales . . . The boron content of illites separated from shales collected from several "known geological environments" increases with the presumed salinity as shown in Fig. 4.

The scatter in points may actually indicate different salinity conditions. Boron-illite ratios from a series of samples collected from a core (California Standard 2-8 Fairybank, [Canada]) plot as a smooth curve (see Fig. 5). The curve indicates a gradually increasing salinity from Cooking Lake to Duvernay time. The salinity then gradually decreases until normal seawater ratios are observed. This change in salinity corresponds to the known geological information regarding these rocks. The data in these two figures indicate that a wide range of paleosalinities can be measured by this method and that detailed ratio curves may be of some use to show the salinity behavior in localized areas.

Conclusions

1. The boron content in brines increases with the salt content (salinity) of the brine over the range studied.

2. Most of the boron in the clay-mineral fraction of sedimentary rocks is contained in the clay-mineral illite.

3. Boron is extracted from the sea water by illite in proportion to the amount of boron present.

4. The boron is strongly fixed into the illite lattice and the amount of boron is not expected to be substantially changed by the normal geological processes affecting the rocks after their formation.

5. Illites extracted from sedimentary rocks from a wide range of geological environments indicate that their boron content can be used to evaluate the relative salinity of the sea at the time the sediment was formed.

TABLE 2—BORON AND ILLITE CONTENT OF SOME SHALES BEFORE AND AFTER CHEMICAL TREATMENT

	Before Treatment		After Treatment	
Sample*	% Illite	p.p.m. B	% Illite	p.p.m. B
Shale 1	50	193	73	217
Shale 2	62	70	81	88
Shale 3	64	160	70	192
Shale 4	64	153	62	154
Shale 5	47	90	53	150

*All of these samples are Cretaceous shales from New Mexico. The formations represented are the Mesaverde, the Green Horn, the Point Lookout, the Pictured Cliffs and the Lewis.

Acknowledgments

Several persons have been closely associated with various parts of the program. John Hower, Jr., now at Montana State University, worked on the project during its early stages; John Wilson has done most of the spectrographic work and T. W. Fancher has made many hundreds of X-ray analyses for the project. The helpful suggestions, ideas, and assistance of these men and other supporting personnel are gratefully acknowledged.

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Drillers busy along Ontario shore

IN 1959 18 companies were engaged in offshore exploration and development drilling on Lake Erie's Ontario side, spending about $2,000,000. These offshore operators completed 73 wells, of which 36 were producers and 37 were dry holes, for a 48% success ratio.

During the season, Place Gas & Oil completed 15 wells. Eleven of these were on Place offshore gas development acreage at Selkirk-Walpole and Port Dover in the eastern part of the lake. Eight of those wells were commercial gas producers. Following completion of an underwater gas-gathering pipeline system, 10 of the 13 commercial wells were placed on production.

West side . . . On the western end of the lake, Place drilled two test wells at South Gosfield Township, both being noncommercial. Following the Imperial-Harvest-Submarine light oil discovery in the Trenton at South Colchester, Place drilled two wildcats on its 9,400 acres of offshore acreage adjoining the discovery area on the south and west.

Initial open flow test of the Place 1 Colchester discovery indicated 250 bbl. of light-gravity oil daily from the Trenton Ordovician at 2,100 ft. This well is producing from the same pay as the onshore wells at Colchester. As additional wells are completed on the Colchester Trenton play, a brand new concept of Ontario's gas and oil potential will develop. The 2 Colchester well, a Place stepout 1½ miles east of the 1 discovery, obtained a marginal flow and was abandoned.

. . . Reserves. Preliminary estimates of the primary recoverable oil reserves at the Place 1 well reveals figures near 2,500 bbl. per acre. An oil reserve of this size allows for a sound economic operation. Ontario, in addition, is a major importer of oil and gas, providing good local market outlet.

. . . Plans. This year's plans for Lake Erie by Place include further development of the Selkirk-Walpole and Port Dover gas fields. At Colchester the company will resume drilling at the 3 and 4 Colchester wells, which were not finished last year due to weather. Following installation of the oil tank battery, the 1 Place well will be hooked up and put on production.

Half-dozen Far-North wells may decide '60 Arctic drilling

A SEXTET OF WILDCATS planned for one of the continent's most remote regions, the Canadian Northwest Territories, may well dictate the exploratory story of 1960. These six wells can do little to evaluate the full worth of the oil potential of this vast wilderness, but one hit would have tremendous bearing on how explorers will attack this wildcat frontier in the future.

Interest began at Eagle Plains

. . . when first oil production in the Yukon Territory was established by Western Minerals et al. at 1 Chance. This oil and gas discovery is the first find in the Far North since Norman Wells 40 years ago. Its location 320 miles northwest of that field, 200 miles south of the Mackenzie River Delta, and not too far south of the Arctic Circle makes it the most significant find in Canada since Leduc. Operators found production at 4,250 ft. in the Permo-Pennsylvanian before suspending operations last summer due to lack of supplies and equipment. Drilling has been resumed this winter, however, and the drill is below 4,300 ft.

Beyond the Arctic Circle

. . . a second Far North wildcat is currently making hole. It is the Richfield et al. Grandview Hills wildcat, 18 miles west of the Mackenzie River and 200 miles northeast of the 1 Chance discovery. Unworldly winter weather and impossible drilling conditions postponed spudding slated for last December. This wildcat has the distinction of being the first drilled north of the Circle. Its progress and outcome will be the key to drilling in the Lower Mackenzie River basin area.

A wildcat is drilling in the Northwest Territories of Canada. It is Western Decalta et al. 1 Rond Lake, situated at Lat. 67° 4′ 30″ N. and Long. 128° 28′ W., 40 miles north of the Arctic Circle.

This is the first of a planned series north of the Circle. It lies 1 mile downdip from the largest oil seep so far found north of Norman Wells. Objective at the new test is the Devonian reef, producer at Norman Wells.

Other Far North drilling

. . . is slated at Celibeta Lake, about 30 miles north of the Petitot River gas field of northern British Columbia. These wildcats, just north of the B. C. border, will be operated by Home Oil Co., Ltd. The wells will be drilled by Home, Signal Oil of California, Kern County Land, Alminex, and United Oils on Canada Southern Petroleums lands. Drilling at Celibeta Lake is of special importance since these two wildcats will be the first on the largest structure known to have mapped by seismic methods in the sedimentary basin of western Canada, east of the mountains. These two bear acute observation.

Two wildcats will be drilled by Imperial Oil Ltd., and Triad Oil Co., Ltd., as part of a large-scale program this year. Only one site has been announced, but two rigs are on the way to Davison Creek, 61 miles northwest of Fort Providence, 155 miles north of the Alberta-N.W.T. border, at a point 9 miles west of the Sixth Meridian.

Explorers eye the Mackenzieland

. . . as a very favorable source of new oil for the world. Here lies one of the biggest untested sedimentary basins on the continent. There are many promising source-bed candidates—the Cambrian through the Permo-Pennsylvanian to the Cretaceous. Explorers have a great task cut out for them in the northland. The drilling season is short in most cases. Transportation problems are gigantic, but these obstacles have been overcome throughout the industry's long pull. Look for some exciting wildcat news in this wilderness soon.

Farflung islands

. . . of the Arctic Archipelago are another one of the last major sedimentary bowls yet to be taken seriously. Inaccessibility has been the big factor preventing exploration in this vast region of islands and straits. This problem, too, can be whipped—maybe not in 1960—but in this decade we will see drilling action beyond the Circle and within a few hundred miles of the North Pole. Last summer there was a big land-buying rush throughout the area after the Geological Survey of Canada completed a survey of 120,000 sq. miles of the Queen Elizabeth Islands at the northern part of the Archipelago. The findings were reportedly favorable to the future of oil exploration in the Arctic Islands. Who will be first to drill this grim province where 45,000 ft. of sediments await the bit?

John C. McCaslin.

Shallow drilling spurts in Illinois' Christian County

A BRISK PLAY that was set off last November in the Mount Auburn oilfield area of Christian County, Illinois, is enjoying continued drilling activity. There are 10 wells going in 15n-1w about 15 miles west of Decatur in Mosquito Township.

The well that started the spirited action in this Illinois basin sector was James Jordan's 100-bbl. per hour strike on Mrs. Vernielle Long Alberts' farm. In 15 hours the well made 950 bbl. The oil was taken out by tank trucks to the Ashland pipeline between Mount Auburn and Taylorville. This field was opened in 1954 by Sun Oil Co. There were eight good wells completed nearby last year.

Present drilling . . . Wells drilling in the area now are Bernard Podolsky 1 Osbern "C," NW SW NW 11-15n-1w, D-1 Osbern in NW NW SW 11-15n-1w, 2 Osbern "C" in NW NW NW 11-15n-1w, James Jordan 3 Alberts in NW SE SW 21-15n-1w, Schaefer Oil Co. 1 Long in SE NW SW 21-15n-1w, Tony Baughman et al. 1 Young in NW SE SE 22-15n-1w, Jordan 2 Butcher in SE SW NW 22-15n-1w, Reeter & Hirstein 1 Burchell in SE SW NE 22-15n-1w, a wildcat at 1 Bailey in SW NW SE 29-15n-1w, and Mansfield 3 Gleeson in NE NE NE 31-15n-1w.

Production in the area is from Silurian at around 1,917-22 ft. The Baughman-Osborn 1 Young well made 72 bbl. per day from that zone on completion last week.

ONE OF Christian County, Illinois' biggest oil wells is James Jordan's strike on the Alberts farm in Mount Auburn field. Flow was 100 bbl. per hour. Tool pushers are trying to dislodge a rock that is partially blocking the big oil flow.

PIPE GOES down the hole. The gusher came in before the well could be cleaned out. Debris in the hole later clogged the well, cutting the flow down to 45 bbl. hourly.

New John Deere 440 Crawler does more work "Single-Handed"!

The John Deere Crawler with Pilot Touch gives you an extra hand to *work* with, because *one* hand on *one* lever does all the driving—steer, stop, go, and reverse. The operator can give full attention to loader, winch, blade, or scarifier—producing more, and doing a better job in the bargain. Less effort is required—practically all clutch and brake footwork is eliminated.

Pilot-Touch control is an optional feature provided on both Diesel and gasoline "440" Crawlers. Any unit in the full line of John Deere Industrial Equipment is available on terms of the John Deere Credit Plan. See your dealer or write for the detailed information you need.

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Drive crawler with left hand—control loader bucket with right—cut cycle time!

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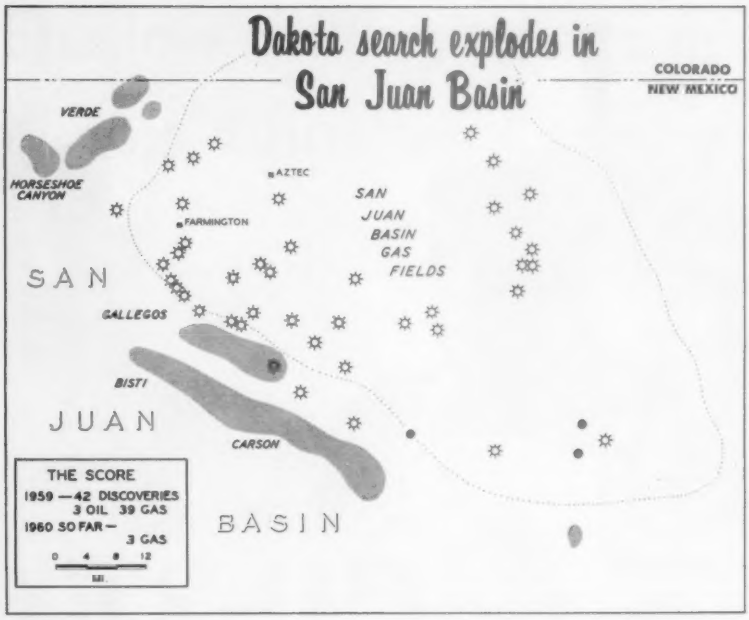


DAKOTA ROCKS are today's big payoff in northwestern New Mexico's San Juan basin.

Southern Rockies play centers along New Mexico border

THE DAKOTA SANDSTONE of Upper Cretaceous age is the prime target in San Juan basin exploration today.

Last year 42 new pools were opened in northwestern New Mexico in this well-known Rocky Mountain pay zone. Of that total 3 were oil, 39 gas. The success ratio for Dakota exploration was a healthy 48%. This year three new gas pools with Dakota pay have already been tapped. Thus it appears that 1960 will be another big year for San Juan, paced by an even more intensified Dakota hunt. The only drawback in a new Dakota completion record could be the lack of outlets. New outlets pending include the "Utah Project" which will send Green River, San Juan, and Canadian gas to the Pacific Coast.

Many of last year's Dakota's strikes were dual completions. Oil and gas pays were found in the Graneros, Mesaverde, and Gallup in 18 of the 39 gas discoveries mentioned above. There will be some incorporation of last year's Dakota strikes eventually into existing fields as development shows they should be.

The Dakota occupies bottom spot on the New Mexico correlator for San Juan basin. San Juan's big pays have always been up the hole in the Graneros, Greenhorn, Mancos, Gallup, and the Mesaverde group. Deeper Dakota rocks weren't touched until a couple of years ago. With the big 1959 exposure of these rocks and concurrent success behind it, San Juan exploration has entered into the deep era that is becoming commonplace throughout the nation's oil provinces.

For the map spotters: Listed below are the Dakota discoveries of 1959. Some are out and out wildcats, others are deeper pool finds in existing production. All, however, are Dakota strikes. Many will end up as pool wells in future tallies.

Rio Arriba County: W. R. Johnston et al. 1-1 Jicarilla, NE SW SW 1-24n-4w. South Blanco field. IPF 1,914 M.c.f.d. from Dakota and Graneros. TD 7,695 ft.

W. R. Johnston et al. 3-9 Jicarilla, SW NE NE 9-24n-4w. Wildcat. IPP 181 BOPD. Dakota. TD 7,425 ft.

Skelly Oil Co. 1 New Mexico-Federal "A," SW NE SE 10-24n-6w. Wildcat. IPF 95 BOPD, Gallup; IPF 899 M.c.f.d. from Dakota. TD 6,750 ft.

Continental Oil Co. 28-1 Jicarilla-Apache, SW SW 20-25n-4w. Wildcat. IPF 202 BOPD, Dakota. TD 7,650 ft.

El Paso 67 Jicarilla-5D, SE SW 29-25n-5w. Wildcat. IPF 4,683 M.c.f.d. Dakota. TD 7,215 ft.

El Paso 109 San Juan Unit 28-7, SE SW 18-27n-7w. Wildcat. IPF 1,562 M.c.f.d. Mesaverde; IPF 1,087 M.c.f.d. Dakota. TD 7,525 ft.

El Paso 98 San Juan Unit 28-7, SW NE 29-27n-7w. Wildcat. IPF 1,621 M.c.f.d. Mesaverde; IPF 2,187 M.c.f.d. Dakota. TD 7,540 ft.

Pacific Northwest Pipeline Co. 33-17 San Juan Unit 28-5, NW SW 17-28n-5w. Wildcat. IPF 4,761 M.c.f.d. Mesaverde; IPF 6,187 M.c.f.d. Dakota. TD 8,174 ft.

El Paso 94 San Juan Unit 28-6, SE NW NE 36-28n-6w. Wildcat. IPF 2,300 M.c.f.d., Mesaverde; IPF 2,564 M.c.f.d., Dakota. TD 7,920 ft.

El Paso 32-29 San Juan Unit 29-5, SE SW 29-29n-5w. Wildcat. IPF 5,038 M.c.f.d., Mesaverde; IPF 3,083 M.c.f.d., Dakota. TD 8,078 ft.

El Paso 27-20 San Juan Unit 30-5, SW SW 20-30n-5w. Wildcat. IPF 2,358 M.c.f.d., Mesaverde; IPF 1,309 M.c.f.d. Dakota. TD 7,890 ft.

El Paso 31 San Juan Unit 30-6, SE SW 33-30n-6w. Wildcat. IPF 5,496 M.c.f.d., Mesaverde; IPF 964 M.c.f.d., Dakota. TD 7,870 ft.

El Paso 16-33 San Juan Unit 31-6, SE SW 33-31n-6w. Wildcat. IPF 1,952 M.c.f.d., Mesaverde; IPF 1,783 M.c.f.d., Dakota. TD 8,182 ft.

San Juan County: Benson-Montin-Greer 1 Pilgrim, SW SW 35-25n-8w. Wildcat. IPP 17 BOPD, Dakota. TD 7,268 ft.

M. J. Brannon, Jr. 28-1 Federal, SW NE NE 28-25n-9w. Wildcat. IPF 3,000 M.c.f.d., Dakota. TD 6,498 ft.

E. P. Campbell 1 E. A. Hanson, NE NE 5-25n-10w. Wildcat. IPF 2,471 M.c.f.d., Graneros and Dakota. TD 6,542 ft.

El Paso 111 Huerfano, NE NW 20-26n-9w. Wildcat. IPF 1,923 M.c.f.d., Gallup; IPF 3.410 M.c.f.d., Dakota. TD 6,785 ft.

El Paso 103 Huefano, SW NE NW 3-26n-10w. Wildcat. IPF 4,460 M.c.f.d., Dakota; IPF 3,342 M.c.f.d., Gallup. TD 7,030 ft.

Tennessee Gas Transmission Co. 2 U.S.A.-W. O. Berger, NW NW 23-26n-11w. Wildcat. IPF 6,686 M.c.f.d., Dakota; IPF 6,262 M.c.f.d., Gallup. TD 6,455 ft.

El Paso 3 Frontier "C," SW NW 19-27n-9w. Wildcat. IPF 2,615 M.c.f.d., Dakota. TD 7,072 ft.

Frontier Refining Co. 2 Evenson-Government, SE SE 19-27n-10w. Wildcat. IPF 8,200 M.c.f.d., Dakota; IPF 4,217 M.c.f.d., Gallup. TD 6,394 ft.

Aztec Oil & Gas Co. 2 Whitely "A," NE SW SW 17-27n-11w. Wildcat. IPF 2,767 M.c.f.d., Dakota. TD 6,540 ft.

Benson-Montin-Greer 1 Bayview-Riddle, NE NE 18-27n-12w. Wildcat. IPF 1,235 M.c.f.d., Dakota. TD 6,032 ft.

Alex N. Campbell 1 Federal-Tonkin, SE SE 23-27n-12w. Wildcat. IPF 4,921 M.c.f.d., Dakota. TD 6,259 ft.

Alex N. Campbell 1 Western, SW NE 25-27n-12w. Wildcat. IPF 3,400 M.c.f.d., Dakota. TD 6,242 ft.

Redfern & Herd 2 Phillips, SE SE 22-28n-11w. Wildcat. IPF 8,429 M.c.f.d., Dakota. TD 6,236 ft.

Pan American 83 Gallegos Canyon Unit, SW NE NE 26-28n-12w. Wildcat. IPF 1,250 M.c.f.d., Dakota; IPF 267 BOPD, Gallup. TD 6,343 ft.

Benson-Montin-Greer 1 Jones, SE SE 17-28n-13w. Wildcat. IPF 1,818 M.c.f.d., Dakota. TD 6,358 ft.

2 Fullerton, SE SE 28-28n-13w. Wildcat. IPF 5,579 M.c.f.d., Dakota. TD 6,363 ft.

Tennessee Gas 1 Eaton Gas Unit, SW SW 25-29n-11w. Wildcat. IPF 4,791 M.c.f.d., Dakota. TD 6,442 ft.

8 Glen Callow, SW SE 27-29n-13w. Wildcat. IPF 3,010 M.c.f.d., Dakota; IPF 514 BOPD, Gallup. TD 6,030 ft.

Southwest Production 1 Callow-Federal, NE SE 33-29-13w. Wildcat. IPF 4,760

M.c.f.d., Dakota; IPF 193 BOPD, Gallup. TD 6,070 ft.

Sunray 1 New Mexico-Federal "K," SW NE NE 6-29n-14w. Wildcat. IPF 845 M.c.f.d., Dakota. TD 5,680 ft.

International Oil Co. 1 E. . Fogelson, SE SE 27-30n-11w. Wildcat. IPF 4,467 M.c.f.d., Dakota. TD 7,080 ft.

Permian Oil Co. 1 Knight, NE NE 5-30n-13w. Wildcat. IPF 4,017 M.c.f.d., Dakota. TD 7,080 ft.

Southern Union 2 McCord, NW SW 34-30n-13w. Wildcat. IPF 3,550 M.c.f.d., Dakota. TD 6,352 ft.

Blackwood & Nichols 58-13 Northeast Blanco Unit, NE NE 13-31n-7w. Wildcat. IPF 2,461 M.c.f.d., Dakota; IPF 6,270 M.c.f.d., Mesaverde. TD 8,127 ft.

Southern Union 1 Nye, SW SW 20-31n-12w. Wildcat. IPF 1,521 M.c.f.d., Dakota; IPF 554 M.c.f.d., Mesaverde. TD 7,176 ft.

Consolidated Oil & Gas Co. et al. 1-35 Government-Payne, NE SW 35-31n-13w. Wildcat. IPF 3,037 M.c.f.d., Dakota. TD 6,874 ft.

Important midpoint set in B.C. gas area

ANOTHER very important link in the growing chain of natural-gas discoveries in the general Fort Nelson district of northeastern British Columbia has been uncovered by Gulf States Oil Co. of Canada.

Gulf States is the Canadian operating subsidiary of Western Natural Gas Co. and the pioneer explorer in the general Fort Nelson district.

Lying immediately between the Prophet River and Clarke Lake gas strikes the new well, Gulf States d-78-I 3 Fort Nelson is also 2 miles northwest and 3 miles southeast of two other wells drilled by Gulf States that failed to find the hoped-for gas zone encountered at this hole. There is a 9-mile channel between the Prophet River and Clarke Lake wells and this new find is 4½ miles from each.

● All of the wells to date in this region have found their major production in the Slave Point-Middle Devonian structure. The Prophet River discovery contains a 15-ft. net pay sector and contains reserves in the order of seven billion, one hundred million cubic feet. On the other hand, the Clarke Lake field until quite recently had had up to 170 ft. of continuous dolomitic pay found in it, and estimated reserves in the order of 175 billion, 660 million cubic feet. A recent well in that latter field has added substantially to it, however, as a recent driller found 314 ft. of continuous porosity. The well was completed with an absolute open-flow potential of about 70 million cubic feet daily.

The new well is situated 4½ miles west-southwest of the original Clarke Lake discovery hole and 6 miles south-southeast of Fort Nelson townsite. The Slave Point on the well was contacted around the 6,160-ft. level and a drill-stem test covering a 60-ft. interval immediately below that depth gave up 8,300 M.c.f.d. through a ¾-in.-choke for 30 minutes and 6,260 M.c.f.d. through a ½-in. choke during the remaining 10 minutes.

Pipe recovery was 10 ft. of water. Drilling crew on the venture was deepening it at last report but it is thought that casing will be run for completion in the near future.

Other wells . . . This firm is currently drilling two other very interesting ventures. One of those offsets the Gulf States 1 Petitot River gas-discovery well, 2 miles to the southeast and is reported to have found the Slave Point at a comparable elevation. Before testing is done on it, however, casing will be run as a precautionary measure in anticipation of the high pressures encountered on the first strike. The company's other test, meanwhile, is near the Gulf States 3 Kotcho Lake gas strike. That well is just in the process of drilling.

The new strike at Fort Nelson is being drilled on British Columbia Petroleum and Natural Gas Permit No. 144. That spread of 231,674 acres was originnally acquired by Hudson's Bay Oil & Gas Co., Ltd., and Union Oil Co. of California. Gulf States then entered into a participating agreement with that firm. Interest in the block is now divided: 40% to Gulf States and 30% each to Union and Hudson's Bay. The discovery well is on the east side of the land spread. Adjoining acreage is also controlled by Gulf States.

A DETAILED AIR SURVEY will cover a wide area of the Appalachian basin this year with completion due next autumn.

Survey set for Appalachians

AN AIRBORNE magnetometer survey of the Appalachian basin area is being flown, it was announced this week by Aero Service Corp., Philadelphia. The detailed air survey will cover 121,500 sq. miles.

The basin has never been thoroughly explored from the air. Aero Service is performing the survey on speculation, and will offer the aeromagnetic maps to oil and gas companies for purchase. It is expected that the survey will yield valuable data for regional basement studies.

The survey area can be enclosed, roughly, in a looping line starting at Albany, and continuing through Buffalo, Cincinnati, Roanoke, Harrisburg, and back to Albany. It includes parts of seven states, as well as the Lake Erie offshore shelf adjoining Ohio and Pennsylvania. Other states partly covered are New York, Kentucky, West Virginia, and Maryland.

The survey plane, a twin Beechcraft, is flying 1,500 ft. above the terrain, along a series of gridded flight lines spaced at 2-mile intervals. A high-sensitivity Gulf airborne magnetometer is being used for the Appalachian survey.

Completion of the survey is scheduled for November 1960, according to Aero officials. First map sheets for the northern area will be available this spring.

Wildcat, three field tests extend Abo

ABO REEF oil production has been extended on the extreme eastern tip of the Empire-Abo area of Eddy County, New Mexico. At the same time, farther east, the first Abo well was completed on the west flank of old production in Artesia field.

Pan American Petroleum Corp.'s 1-BC State is the 1¾-mile-east extension to the Empire-Abo field, and the first Abo producer in Artesia field. On a 16-hour potential test, the well flowed 92 bbl. of 42°-gravity oil and 6 bbl. of acid water through 16/64-in. choke. Tubing pressure was 750 psi. Gas-oil ratio was 780:1.

Pan Am's well attracted considerable interest when it drilled into the Abo at 6,120 ft., and then logged more than 200 ft. of reef section in going to total depth of 6,367 ft. For completion, perforations were made at 6,128-52 ft.

No. 1-BC State is in the SE NW 5-18s-28e, and about 18 miles southeast of Artesia.

Meanwhile, more extensions . . . Three wells on the north, and eastern end, of Empire-Abo field have been completed for flowing potentials ranging from 108-456 bbl. of oil a day. All of these wells were in 6-18s-28e.

First completion of any kind (according to one development map) has been made in 5-18s-28e, which is midway between the Empire-Abo field. and Pan Am's discovery. Leonard Oil Co. 2-E State flowed 264 bbl. of oil a day through 16/64-in. choke, from the reef at 6,220-45 ft. Tubing pressure was 500 psi. Gas-oil ratio was 1,473:1. Location is in SE NW 5-18s-28e.

And slim hopes . . . Three miles east of Dayton townsite and about 2 miles southwest of Abo production in the Empire field, the chances for extending Abo oil were getting dim. British-American Oil Producing Co. 1 Pluma in SE SW 19-18s-27e, recovered gas but no shows of oil on three drill-stem tests between 5,450-5,850 ft. Operators were drilling ahead on projected depth of 6,000 ft. where it will stop to check electrical surveys.

CORRECTION

On p. 150 under "new drilling records" in the Annual Number, January 25, 1960, Union-Ohio 1 Kenai, Alaska, "Dry at 14,676 ft." should read "Gas discovery at 15,047 ft."

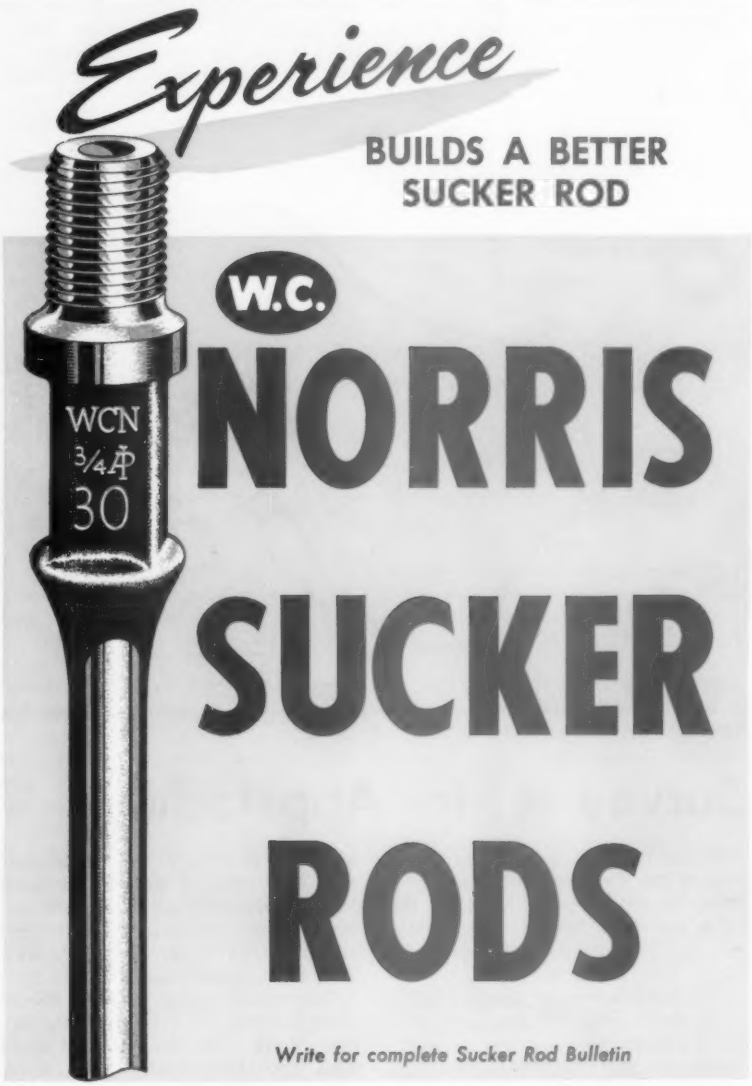
Colorado wildcat has good gas show

In Colorado, Pan American Petroleum Corp. has reported good recovery of gas from a wildcat in Moffat County.

Pan-Am and others 2 Four Mile Creek Unit, flowed gas at the rate of 11 M.M.c.f.d. on a calculated open-flow potential from the basal Lance, Upper Cretaceous through perforations 3,612-18 and 3,624-30 ft.

The well is located 1 mile north of Pan Am's and others initial discovery in the area, which was completed in November 1958, for an open flow potential of 10,000 M.c.f.d. Recovery on the discovery well was from a different section of the basal Lance formation.

The 2 Four Mile Creek Unit, located in 33-12n-91w, was drilled to a total depth of 4,297 ft., plugged back to 3,655 ft. Pan Am owns half interest in the well, and the other half is owned by Phillips Petroleum Co. and Kerr-McGee Oil Co., each with 20%, and Kirby Petroleum Co., with 10%. Pan Am, unit operator, also owns 10,350 net acres in the area.



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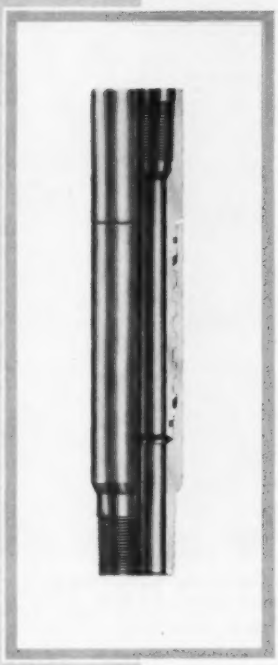

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First Cape Breton try is dry hole

THE FIRST ATTEMPT to find oil by Imperial Oil Ltd. in Cape Breton Island, Nova Scotia, ended as a dry hole. Imperial's 1 Mabou finished as a failure at 5,145 ft. The rig was moved to the 1 Port Hood location.

The dry hole on Cape Breton was in the Lake Ainslie area, south of Inverness. Preliminary exploratory work was done on about 280,000 acres about 3 years ago. The search for oil here began as long ago as 1864 when two dry holes were drilled. This hunt continued through the years in spurts. The Port Hood test is now the only Imperial drilling in the Maritimes.

Work on Prince Edward Island was suspended.

Important Oklahoma test dually completed

One of the year's first important discoveries in Oklahoma is a Cities Service Oil Co. wildcat in Canadian County. It is the 1 Porter-B in C NE SW 5-12n-8w.

Potential test of the Bromide Ordovician sand at the well through perforations at 12,340-12,475 ft. had a 1-point calculated open flow of 4,900 M.c.f.d. On test through 20/64-in. choke it made 3,500 M.c.f.d. On a 24-hour test it flowed on 20/64-in. choke for 13 hours and ½-in. opening for 11 hours, making 2 bbl. distillate and 74 bbl. load water. On an earlier test of McLish-Ordovician perforations at 12,624-12,744 ft. a 4-point potential was 4 M.M.c.f.d. Total depth is 13,366 ft.

Pennsylvania well hits gas pay

GAS SHOWS are reported at an important deep wildcat in Warren County, Pennsylvania. The well is Biery & Johnson Co. 1 Frank Kapp in Limestone Township, 1,800 ft. north of 41° 40' and 11,000 ft. west of 79° 20'.

Operators found 300 M.c.f.d. in the Red Medina sand at 5,719-29 ft. Drilling is now at 5,733 ft. This is a very significant wildcat for Pennsylvania. If it is completed as a commercial gasser it will cause more drilling in the area. The same operator drilled a well to the Gatesburg Cambrian in 1957 and found shows. One show was in the Medina. The Kapp well is located about 2 miles north of that Gatesburg test.

Another well completed in 1928 by Fidelity Petroleum Co. had a show in the Medina Silurian.

It is located about 4 miles west of the Kapp well. Nearest deep production is 25 miles northwest.

Ohio's Fallsbury keeps fast pace

Fallsbury pool in Fallsbury Township, Licking County, continues to yield good Clinton producers.

A ½-mile stepout on the western edge, George Gearhardt, 1 S. J. Cullison, Section 7, tested 105 BOPD with 325 M.c.f. of gas after fracture. Also, another offset by Waverly Oil Works, 5 W. F. Miller, Section 11, in the eastern portion of the pool made 100 BOPD with 750 M.c.f. of gas after fracture.

The sand was reported at 2,901-38 ft. for the Cullison and 3,047-90 ft. for the Miller.

Kentucky adds dry hole in Whitley County

In Whitley County, southeastern Kentucky and located in the Saxton Quadrangle, M. B. Piper has completed 1 Gatliff as a dry hole. Mississippian Big lime was topped at 1,740 ft. and hole drilled to 1,970 ft. total depth.

California San Emidio extension successful

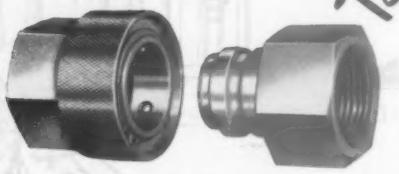
Richmond Oil Corp. completed a well in SE SE 9-11n-21w as the San Emidio field's most southerly producer to date. This deep test, 87-9 KCL H, was completed in the interval 12,920-12,835 ft. for 382 bbl. daily of 31.5°-gravity crude through a 16/64-in. choke. Total depth was 13,003 ft.

Kings County gas extended in California

The small Harvester gas field in Kings County was extended ½ mile north of the discovery well by a test drilled by Beach, Church and Bell, operators. The extension, 1-12 Berverdor, was completed in the Myra sand at 2,804 ft. It tested at a rate of 400 M.c.f.d. through a ⅛-in. choke before being shut in pending a pipeline connection.

Also in Kings County, the same operators made a small new gas pool find in a shallow sand about 1½ miles northwest of the Trico-Northwest gas field. The new find was perforated between 904-905 ft. for 50 M.c.f.d.

ALL-PURPOSE QUICK COUPLINGS BY *Roylyn*



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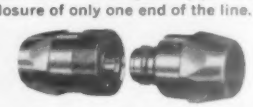

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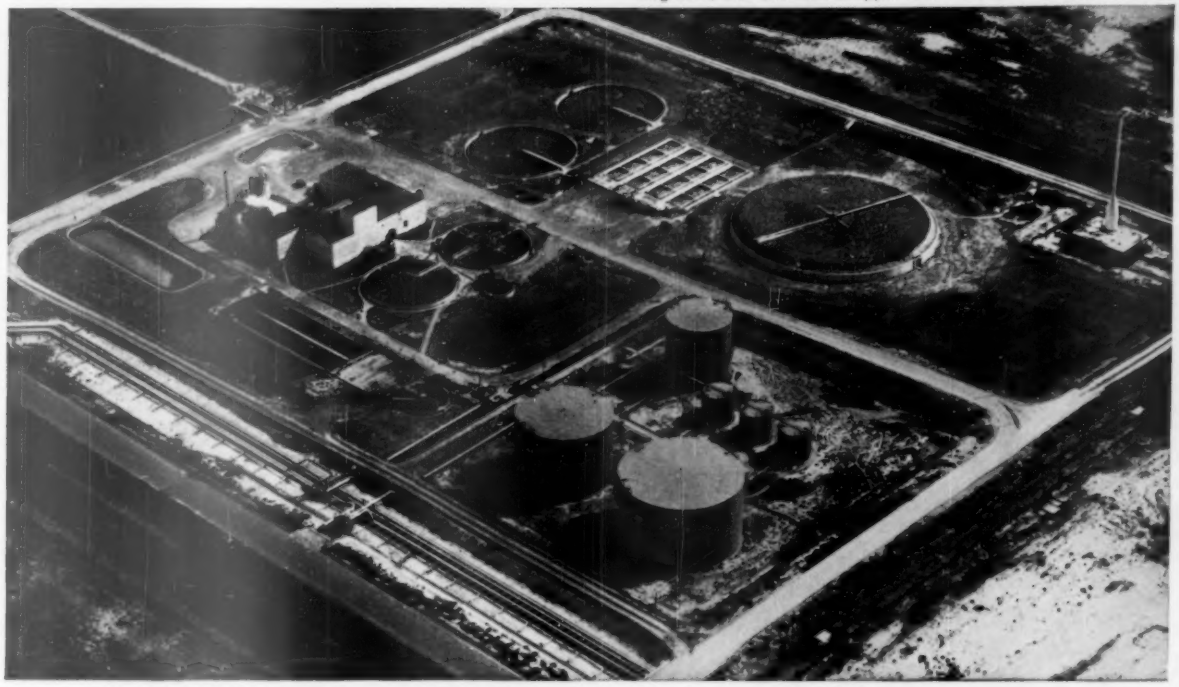
Aerial view of treatment plant shows Dorrco Clariflocculators in left foreground, and Clarifiers at upper left. Distributor is at upper right.



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Unique treatment plant meets strict requirements in Puget Sound area . . . using Dorr-Oliver equipment

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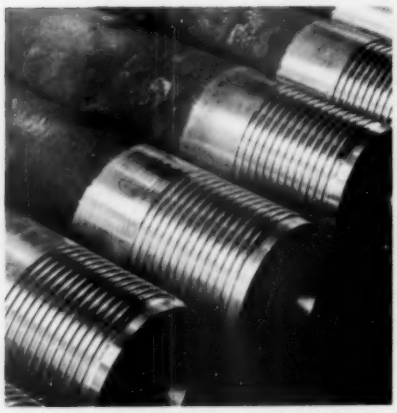
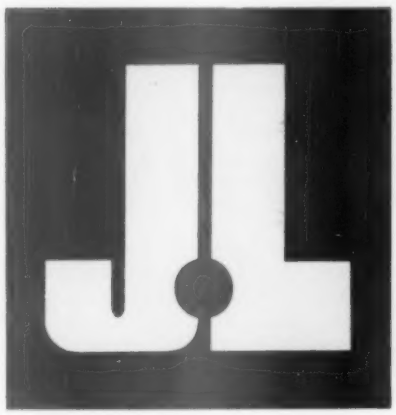
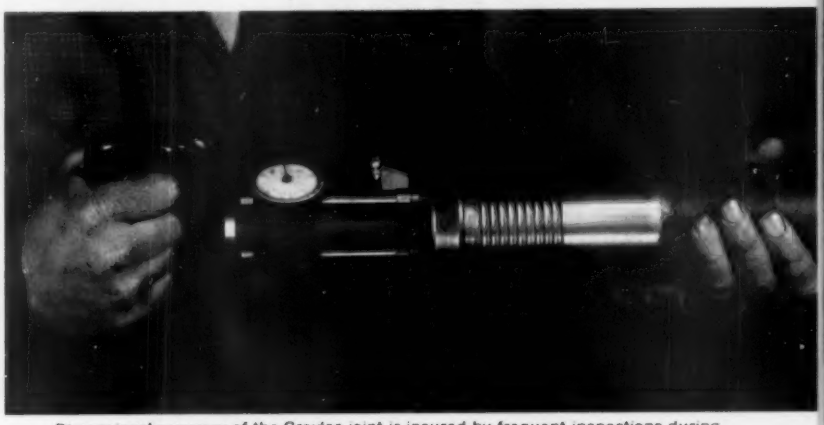


Modified Acme-type threads provide easy stabbing, fast make-up, high resistance to damage.

Grayloc joint is machined on special facilities at J&L's Aliquippa (Pa.) Works.





Dimensional accuracy of the Grayloc joint is insured by frequent inspections during machining operations. It is available in grades J-55, N-80 and P-105.

"We used J&L Grayloc tubing because of limited clearance and high pressures encountered in this dual completion well"

. . . reports Texas driller

Producing a high pressure gas-distillate well with two tubing strings inside a 7-inch casing calls for engineering know-how and a superior tubing product. Bright & Schiff Company of Dallas, Texas, selected J&L Grayloc tubing for the job. Here's why:

Grayloc tubing, except in heavy weights, has smaller joint diameters than conventional external upset tubing. This added clearance makes the Grayloc joint especially suitable for use in multiple completion wells.

Heavy, square Grayloc threads provide easy stabbing, fast make-up and high resistance to damage. Strength of the Grayloc joint in tension exceeds that of the pipe body itself.

A separate alloy sealing ring provides the primary sealing force. The self-energized ring provides a positive, metal-to-metal seal. Grayloc joints will withstand the highest well pressures yet encountered.

For more information on Grayloc tubing, contact your nearby J&L Supply Division representative. Or write directly to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

FROM ROTARY RIG...

Neoprene Can Cut Your Costs. In the field, where every minute counts, downtime is costly. That's why you'll so often find neoprene on the job. Neoprene's unique *combination* of properties is particularly well suited for rough drilling rig conditions.

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Specify neoprene the next time you buy your rotary hose, pipeline scraper cups and other oil field rubber products. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department OG-2, Wilmington 98, Delaware.

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TO PIPELINE PIG

Refugio Cove extended in California

The Refugio Cove gas field in Santa Barbara County was successfully extended almost 1 mile south of the discovery well by Texaco Inc. The Texaco well, 1 Texaco-Monterey-Rutherford, was completed in the Oligocene - Sespe formation between 3,105-32 ft. for 1,012 M.c.f.d. through an 18/64-in. choke. The field discovery was brought in by Sunray Mid-Continent Oil Co. in July 1958, for 3,900 M.c.f. through a ¼-in. choke.

California yields another gas discovery

The active Arbuckle gas field of Colusa County yielded its second significant gas-field discovery in recent weeks. The latest find was scored by Western Gulf Oil Co. on a site about 6 miles southeast of Arbuckle. Several weeks ago, Cameron Oil Co. made a similar new gas-field discovery about 10 miles northeast of Arbuckle.

The Western Gulf discovery, 1 F. J. Strain, was completed in a perforated interval between 8,468-87 ft. for 2,910 M.c.f.d. through a ⅜-in. choke. Total depth of the discovery, California's first gas field find of the year, was 8,971 ft.

In the Arbuckle field proper, Occidental Petroleum Corp. continued its successful operations on acreage farmed out from Western Gulf by completing an extension test ½ mile west of the nearest field producer. No details were released.

Discovery wells

CALIFORNIA

Colusa County: Western Gulf Oil Co. 1 F. J. Strain, NE NE 14-13n-1w, 2,910 M.c.f.d., ⅜-in. choke, perfs. 8,468-87 ft., TD 8,971. (New field discovery 6 miles southeast of Arbuckle gas field).

Cameron Oil Co. 1 Cameron-Armstrong, SE NE 7-14n-1e, 4 M.M.c.f. daily (estimate), TD 7,528 ft. (New gas-field discovery 10 miles northeast of Arbuckle gas field.)

Kern County: Tidewater Oil Co. 15-2 KCL, NW SW 2-31s-26e, 232 BOPD, 34° gravity, 0.1% cut, ⅜-in. choke, perfs. 8,873-8,940 ft., TD 8,941 ft. (New field discovery northeast of Paloma).

WESTERN CANADA

Alberta: Great Plains 9-9 Three H. Choqua, LSD 9, 9-31-23w4. Basal Quartz oil discovery. TD 7,500 ft.

Phillips 2-18 Kaybob, LSD 2, 18-63-18w5. Notikewin gas discovery. TD 10,140 ft.

McGaha 10-11 Samson Lake, LSD 10, 11-44-23w4. Basal Quartz gas discovery. TD 4,906 ft.

British Columbia: Triad D-28-J Beatton River, 28-J-94-H-2. Triassic oil discovery. TD 3,810 ft.

Saskatchewan: Hudson's Bay 16-34-1-5w2 Pinto, Mississippian oil discovery. TD 5,346 ft.

COLORADO

Garfield County: The California Co. 1 Shaeffer, NW NW 12-7s-93w. IP Shut in gas discovery, Corcoran discovery, new field. TD 8,733 ft.

Logan County: Kimbark Exploration Co. 1 State, C NE NW 10-6n-53w. IPF 950 M.c.f.d., 20 BWPD, "D" sand discovery, new field. TD 4,700 ft.

Washington County: Anderson-Prichard Oil Corp.-Tipps Drilling Co. 1 Ben Gay, NE NE 1-4s-54w. IPP 170 BOPD, and 2% bsw. "J" sand discovery, new field. TD 4,830 ft.

ILLINOIS

Brown County: Charles Eager 1 Wm. L. Davis, SE SW SE 8-2s-4w. IP 530 BOPD, Silurian 634-635 ft. TD 635 ft. New field discovery . . . East Siloam.

Lawrence County: John J. Oslager 1 Shick, NW SE SW 16-3n-13w. IP 1,140 M.c.f.d., Aux Vases 2,566-76 ft. TD 2,791 ft. Opens South Sumner field.

INDIANA

Spencer County: Otis Greer 1 Mills, NE SE NW 6-6s-4w. IP 105 BOPD, Jackson 680-699 ft. TD 699 ft. Opens East Union Chappel field.

KANSAS

Barber County: Ryan Consolidated Petroleum Corp. 1 Woods, shut in gas well. 500 M.c.f.d., Dough sand 4,160-62 ft. TD 5,099 ft.

Barton County: Petroleum Inc. 1 Straub "C," SE SE NW 20-18s-11w. IP 32 BOPD, Lansing Kansas City 3,226-66 ft. TD 3,414½ ft. Opens new pay in North Feist.

Chase County: Anderson-Prichard Oil Corp. 1 Koegeboehn, NE NE NE 19-19s-6e. IP 17 BOPD, 29°, Viola 2,052-73 ft. TD 2,285 ft. Opens Koegeboehn pool.

Clark County: Sinclair and Texaco Inc. 1 Campbell, C SE SE 30-34s-21w. IPF 7,100 M.c.f.d., Morrow 5,526-40 ft. TD 5,749 ft. New field.

Ellis County: Petroleum Inc. 1 Meistrell "D," SW NW NE 9-11s-18s. IP 72 BOPD, 32.8°, Lansing - Kansas City 3,322-32, 3,291-95 ft. TD 3,662 ft. Opens Southwest Meistrell field.

L. J. Dreiling 5 Dickinson, SW NE SE 10-12-16w. IP 98 BOPD, Lansing-Kansas City 3,102-07 ft. TD 3,450 ft. Opens Blue Hill field.

Grant County: Pleasant Prairie Oil Inc. 1 Pollyanna, C SE SE 36-27s-35w. IP 200 BOPD, Lansing 4,138-4,140 ft. TD 5,659 ft. New field, Pollyanna.

Harper County: Mull Drilling Co. 1 Zuercher, C NE SW 18-32s-7w. IP 3,750 M.c.f.d., Miss. 4,420-41 ft. TD 4,855 ft.

Morton County: Pan American 1 Kinsler, NW NW SE 33-31s-40w. IP 19,600 M.c.f.d., Des Moines 4,335-39 ft. St. Louis 5,464-66 ft. TD 5,927 ft. New field.

Rush County: Thunderbird Drilling Co. 1 Kober, NE SE NE 18-19s-20w. IP 139 BOPD, 37°, Cherokee 4,323-38 ft. TD 4,446 ft. Opens Kober field.

Stafford County: Thunderbird 1 Waters, NE NE SE 33-24s-14w. IP 10 BOPD, 31°, Lansing-Kansas City 3,816-20 ft. TD 4,280 ft. Opens East Waters field.

Stanton County: Western Natural Gas Co. et al. 1 Beaucamp, C NE 23-30s-41w. IP 456 BOPD, 39°, Chester 5,338-44 ft. TD 5,556 ft.

Pan American 1 Shore Gas Unit "P," NE NE SW 22-30s-40w. IP 73 BOPD,

(Continued on page 181)

SECONDARY RECOVERY

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VALVES

William E. Howell
. . . sets fast pace for Oklahoma City firm.

Fain Porter Hits Near Home

. . . with a wildcat success ratio of better than 1 out of 2 for 1959. Howell is signal caller for the company.

WHILE many U. S. companies are expanding the oil search to foreign lands, an Oklahoma City independent firm is making a backyard operation pay off.

Fain Porter Drilling Co. — which has branched out into oil and gas production—has centered most of its activities in three south central Oklahoma counties within 120 miles of its Oklahoma City headquarters.

But it's far from being a hip-pocket outfit. It's a compact, going concern. Take a look at Fain Porter's 1959 drilling success record:

. . . **Of 11 wildcats,** six were discoveries and five were dry for a 54% or better than 1 out of 2 success ratio. The national average is 1 out of 9.

. . . **A 78% success** record for development wells, 15 producers out of 19 wells drilled.

Largely responsible for Fain Porter's success is William E. Howell, slender, peppery, 41-year-old president.

Howell, who has been with the company less than 4 years and has seen the number of employes grow from 40 to 115, credits an alert and able staff for the efficient operations. He has surrounded himself with a group of youthful and active oil hunters whose touch so far has bordered on magic.

Howell himself is no ordinary oil-company president. For instance, he visits every one of the company's drilling operations monthly and knows the toolpushers and drillers on the firm's six rigs personally.

Howell joined the company when his own production and land holdings were merged with Fain Porter in May 1956. The company's board chairman is Frank M. Porter, president of the American Petroleum Institute.

Operations . . . Like other companies caught in the squeeze in recent years, Fain Porter has put added emphasis on cost cutting.

The company spent $1 million last year replacing and repairing drawworks and derricks for its operations, principally in McClain, Garvin, and Cleveland counties.

Fain Porter also is ready to contract drill as well as test its own land holdings. Howell believes a company should insist on an interest in every well it drills.

Fain Porter also is a champion of wider spacing, and a company policy calls for personal contact with land and royalty owners to point up the economic waste of needless drilling.

Howell isn't critical of others, but he's convinced an above-board system is best.

"We try to be open and completely frank with landowners and royalty holders," he says. "We never hesitate to show our reserve figures.

"It's the duty of us in the industry to quit fighting these people and tell the whole story. The people benefit as much as the operator. They just must be convinced."

At a recent hearing before the Oklahoma Corporation Commission, the bantamweight Fain Porter group, seeking 80-acre spacing, was pitted against a small bloc of large company representatives and a group of landowners who wanted 40-acre spacing.

During a recess, the Fain Porter team invited the landowners and oth-

▶▶▶ Personals

Gardiner Symonds, chairman of Tennessee Gas Transmission Co., has been elected a trustee of Stanford University.

Howard B. Shelton, formerly division manager in Billings, Mont., for Sohio Petroleum Co., has been named head of the gas-gasoline division in Oklahoma City. Sohio's northwest division office in Billings will be closed in a move to streamline exploration activities. Most of the company's 45 employes in Billings will be transferred to other areas.

Gerald E. Pfenning, district drilling foreman for Shell Oil Co. in Bakersfield, Calif., has been named district production foreman there. **Burton C. Carlson,** mechanical engineer in Farmington, N. M., has been transferred to Ventura, Calif., in the same capacity.

Richard J. Stewart, district geophysicist in Durango, Colo., for Tennessee Gas & Oil Co., has been transferred to Denver. **B. J. McAlpine,** formerly geologist in Durango, has moved to Oklahoma City, and **Donald Mahaffey,** Jackson, Miss., geologist, has moved to Durango. Also, **Jerrold G. Thompson,** formerly geologist in Denver, has been transferred to Casper, Wyo. **Howard Johnson,** operations foreman in Wichita Falls, Tex., has been transferred to Farmington, N. M.

ers to join them in a quick briefing. Maps were spread out and geologists explained the advantages of wider spacing in detail. Back in the hearing room, the decision went to the underdog Fain Porter.

Howell isn't letting the present blush of prosperity and good luck blind him to future needs. Four college students, seeking degrees in engineering, geology, statistical work, and business administration, are working for Fain Porter as trainees. They are being groomed to step into the fast-moving Sooner drilling outfit.

An oil background . . . Howell, whose father was an oil operator, was born in Okmulgee, Okla., and lived there and in the Beggs, Okla., oil area before moving to Tulsa, where he attended high school.

While taking 2 years of law at the University of Tulsa, Howell spent the summers roustabouting in Osage and Okmulgee counties and in West Texas for Stanolind Oil & Gas Co. (now Pan American). He also worked in the production and land department of Stanolind.

After 2 years of college, Howell dropped out, quit a big company career, and struck out for himself. He slowly acquired small chunks of production. In 1947, the William E. Howell Co. moved to Oklahoma City. The Fain Porter merger came in 1956.

When he left the campus, he didn't halt his education. He's completed five correspondence courses, including one in geology and one in petroleum engineering. He also learned to fly a plane and occasionally pilots the company plane on business flights, just to spell the regular crew.

He's a director of the Independent Petroleum Association of America and a former director of the American Association of Petroleum Landmen.

Howell has set the pace for Fain Porter, and it isn't slowing down. While the company's one development well drilled so far this year was dry, it's lone wildcat turned out to be a gas discovery.

Joe Cox, Superior Oil Co., has been elected president of the Wyoming Landman's Association. **Joseph K. Caskey,** Sunray Mid-Continent Oil Co., has been named first vice president, with **W. P. Wimbish,** Gulf Oil Corp., as second vice president. Other new officers include **Bill Hollander,** Shell Oil Co., secretary; **Jim Beasley,** Lion Oil Division of Monsanto Chemical Co., assistant secretary; and **Donnell Wells,** Continental Oil Co., treasurer.

Harry F. Swannack, Gulf Oil Corp.'s area production superintendent in Bay City, Mich., has been transferred to Odessa, Tex.

Joe F. Moss, district geologist in Lafayette, La., for Southwest Gas Producing Co., Inc., has been promoted to South Louisiana district exploration manager in Lafayette.

Paul F. Newton, petroleum engineer with Plymouth Oil Co., has been named representative for Plymouth in its joint exploration on the Ivory Coast of French West Africa. Plymouth, Benedum-Trees Oil Co., and Ste. Africaine des Petroles have a joint concession in the area.

Dan H. Sebastian, member of Denver United States National Bank's oil department since 1953, has been elected a vice president of the bank. **John H. Ferry,** petroleum engineer in the department, has been named assistant vice president.

Douglas Williams, Sun Oil Co., has been elected president of the Durango, Colo., Petroleum club. Other new officers are **Homer Olivier,** Tidewater Oil Co., vice president; **James Clayton,** Shell Oil Co., secretary; and **Ray Duncan,** Duncan Oil Properties, treasurer.

William A. Walther, Jr., assistant division production superintendent in Houston for Sinclair Oil & Gas Co., has been transferred to Tulsa as assistant division production superintendent. He succeeds **Joe Mefford,** who recently was named division production superintendent in Midland, Tex. Walther has been assistant district superintendent in Silsbee, Tex., for Sinclair and had held the Houston post since 1957. He was with Southern Production Co. when the company was purchased by Sinclair in 1956.

Lawrence L. Smith, formerly on special assignment during organization of Amoco Fina, S. A., has been appointed general manager of manufacturing for Amoco Chemicals Corp., a new position. He will continue as a director of Amoco Fina and as a director of Amoco Chemicals. In the new post Smith will be in charge of manufacturing operations, engineering and construction of manufacturing facilities, and supply and transportation. Smith has been with subsidiaries of Standard Oil Co. (Ind.) since joining Pan American Petroleum Corp., then Stanolind Oil & Gas Co., in 1946. He is a former president of Hidalgo Chemical Co., one of the companies merged into Amoco several years ago.

▶▶▶ Personals

John M. Starke, vice president of Southern Natural Gas Co., will be vice president in charge of the company's new oil and gas and gas supply division, Houston. The new division will combine the old gas supply and exploration and production divisions. Exploration and production offices will be moved to Houston from New Orleans around March 1. A district office will be located in New Orleans and another is planned in Jackson, Miss. **W. E. Dunn** will continue as vice president in charge of exploration and production for the company.

STARKE

R. L. Mason, development engineer in Taft, Calif., for Standard Oil Co. of California, has been promoted to general engineer with Standard of California, Western Operations, Inc., in Vernal, Utah.

Dean L. McGregor, Jackson, Miss., district marketing manager for Continental Oil Co., has been promoted to manager of the New Orleans marketing division. He succeeds **W. S. DuLaney,** who has been transferred to Jackson. Also, **Ralph A. Roseland,** New Orleans district marketing manager, has been appointed sales development manager for the division. **Robert C. Hager,** formerly in Jackson, will succeed Roseland.

Robert J. Moore, research group leader at Shell Oil Co.'s Martinez, Calif., refinery, has been named assistant chief research chemist. **Robert J. Gordon,** senior research technologist at Martinez, has been appointed a group leader. **Pratt L. Greer,** Martinez research technologist, has been transferred to San Francisco as technologist in products application.

R. J. Forrest, general superintendent of Oklahoma Mississippi River Products Line, Inc., has been elected vice president and general manager. He succeeds **J. R. Ellis,** who has resigned to open consulting offices. Ellis has been with Oklahoma Mississippi River since 1953. He was with Sunray Pipe Line Co. and Great Lakes Pipe Line Co. before that time. **Kenneth E. Hill,** Eastman Dillon, Union Securities & Co., New York; **John F. Curran,** Sunray Mid-Continent Oil Co., Tulsa; and Forrest have been elected directors of Oklahoma Mississippi River Products.

Personals

Robert L. Minckler, senior vice president of Mobil Oil Co., will retire about the middle of the year. Minckler was president of General Petroleum Corp. from 1948 until it was merged with the parent company earlier this year. He was slated to move to New York in an executive post with Mobil Oil before deciding to retire. Minckler joined General Petroleum in 1924, was named assistant to the president 10 years later, and was elected a director in 1941. He became a vice president in 1945, executive vice president in 1947, and president in 1948.

Byron L. Plumley, senior petroleum engineer with Sinclair Oil & Gas Co., has been transferred to Fort Morgan, Colo., from Casper, Wyo. **Adolph J. Disalvo,** senior production engineer, has been transferred to Casper from Denver.

John L. Gillis, a director, executive committee member, and vice president in charge of marketing for Monsanto Chemical Co., has been elected a director of Chemstrand Corp. He succeeds **Charles S. Cheston** on the Chemstrand board. Cheston has retired after 10 years as a director.

Frederick D. Marts, general superintendent of Jayhawk Pipeline Corp., has been elected vice president and general superintendent. Marts had been with Panhandle Eastern Pipe Line Co. and Platte Pipe Line Co. before joining Jayhawk in 1958 to oversee construction of the line. Jayhawk is jointly owned by Colorado Oil & Gas Corp. and National Cooperative Refinery Association.

L. H. Huth, superintendent of the operating division at the Mandan, N. D., refinery of Standard Oil Co. (Ind.), has been named manager of operations for Amoco Chemicals Corp., Indiana Standard subsidiary. Huth will supervise operations for Amoco's Joliet, Ill., Seymour, Ind., and Texas City plants. He had been at Mandan since 1954.

Orville Farlow, Jr., petroleum engineer with Sinclair Oil & Gas Co., has been transferred to Houston from Fort Morgan, Colo. Farlow has been with Sinclair since 1952.

C. W. Gilmore, formerly technical director for Great Northern Oil Co. in St. Paul, has joined Wilshire Oil Co. as process superintendent in Santa Fe Springs, Calif.

Richard C. Watkins, Jr., refinery manager for Utah Oil Refining Co. in Salt Lake City, has retired after 38 years with the company. **Cecil W. Nysewander,** maintenance superintendent for the company, has been promoted to operating division superintendent, a new position. **Hugh M. Thomson,** chief engineer, has been named engineering and maintenance division superintendent at the Salt Lake City refinery.

William A. Sullender, formerly assistant general manager of operations in American Oil Co.'s marketing department, has been named general manager of distribution in charge of operations for all company terminals. Terminal operations, formerly handled by the marketing department, have been placed under the supply and transportation department.

James C. Tilley, assistant manager of Sun Oil Co.'s New York sales region, has been appointed manager of the southeastern sales region. He will headquarter in Jacksonville, Fla. **William H. Van Scoyoc,** manager of retail sales in the New York region, will succeed Tilley there.

Will Taff, associate director of Esso Research & Engineering Co.'s process research division, has been given a special assignment to assist management in finding ways to improve effectiveness and reduce company operating costs. Taff has been with Esso Research since 1939 and had been associate director of process research since 1958.

Sam Hastings, section head in the Humble Division of Humble Oil & Refining Co.'s research and development division, has accepted a loan assignment with Esso Research & Engineering Co. as an assistant director in the analytical research division. In other Esso Research appointments, **William King,** analytical research, and **Pat McCall,** process research, have been named research associates. **James Wilson,** mechanical division, and **William Ludi,** construction engineering, have been appointed engineering associates.

C. A. Talbott, engineer with Standard Oil Co. of Texas, has been transferred from Monahans to Snyder, Tex.

Dr. F. S. Mortimer and **Dr. C. D. Wagner,** research chemists for Shell Development Co., have been named supervisors of research at the company's Emeryville, Calif., research center.

J. R. Stitt, formerly coordinator of marketing for Oronite Chemical Co., has been named head of the new petroleum and rubber chemicals sales division. He will continue to headquarter in San Francisco.

E. D. Brockett, who recently was named executive vice president of Gulf Oil Corp., has been elected a director of the company. **Kermit Roosevelt,** director of governmental relations, and **David T. Searls,** general counsel of Gulf, have been named vice presidents.

Harry Williams, Shell Oil Co., has been elected 1960 president of the San Joaquin, California, Oil Scouts and Landmen's Association. He succeeds **Hollis Bertrand,** Honolulu Oil Corp. Other new officers are **William Horsley,** Richfield Oil Corp., vice president; **P. M. Colahan,** Monterey Oil Co., secretary; **Henry Dawson,** Humble Division of Humble Oil & Refining Co., editor; and **Cliff Edmundson,** Shell, assistant editor.

Dr. James C. Baird, Jr., has joined California Research Corp. as research chemist in the analytical and physical measurements division of the Richmond, Calif., laboratory. **Dr. Don D. Gilbert** also joins this division at Richmond. **Roger T. Johnson** has joined the chemicals process development division, Richmond, as a research engineer. At the company's La Habra, Calif., lab, **Dr. Edward J. Koval** has joined the oil recovery division.

Deaths

Earle W. Gard, vice president of Ralph M. Parson Co., died January 23 in Los Angeles. Gard was vice president of Bechtel-McCone-Parson Co. from 1946 to 1954. He had been an engineer with Union Oil Co., specializing in natural gasoline processing, before that time.

Laurence R. Jones, 44, president of Laurence Jones Oil & Operating Co., Kansas City, and of A. R. Jones Oil & Operating Co., Corpus Christi, Tex., died January 25 in Kansas City after

Personals

Fred L. Hartley, vice president and director of research for Union Oil Co., has been elected senior vice president and a director of the company. He will be responsible for all marketing operations. **Arthur C. Stewart,** director and senior vice president, who had supervised marketing operations, will be responsible for research, purchasing, and the medical department. Stewart also has been named a director of Collier Carbon & Chemical Corp., a subsidiary. **C. Haines Finnell** has been appointed director of marketing. **F. K. Cadwell** has been appointed director of export and refinery bulk sales. **Dr. W. E. Bradley** will succeed Hartley as director of research. **Jerry Luboviski** has been named manager of advertising and sales promotion, and **Earl M. Welty** has been appointed director of public relations.

HARTLEY

J. M. Williams has been promoted to senior coordination technician in the coordination division of Humble Oil & Refining Co.'s Baytown, Tex., refinery.

Brandon D. Nuttall, formerly western Kentucky area geologist for Pure Oil Co., has resigned to open consulting offices in Madisonville, Ky.

E. O. Buck, senior vice president of the National Bank of Commerce, Houston, and head of the bank's oil and gas loan department, has been appointed to the National Petroleum Council. Buck was manager of Rowan Drilling Co. before joining the bank. He also had been with the Conroe Operators' Association, Texas Railroad Commission, and Gulf Oil Corp.

Arthur P. Foster, Jr., reservoir engineer with Texaco Inc. in Dallas, has been promoted to district reservoir engineer and transferred to Shreveport, La.

Richard J. Grant has been promoted to senior chemist in Pittsburgh Coke & Chemical Co.'s physical chemical research group, research and development department. He has been with the company since 1950. **John E. Urbanic** has joined the research and development department as a chemist.

Charles A. Floto, executive vice president of Benedum-Trees Oil Co., has been elected president. He succeeds the late Michael L. Benedum, founder of the company. Floto has been with Benedum-Trees since 1915.

Claud B. Barrett, senior vice president, a director and chief executive officer in Houston for Texaco Inc., has been elected chairman of the Houston First Federal Savings & Loan Association.

Bill B. Murray has joined Wilshire Oil Co. of California as manager of operations. He will be responsible for supervision of transportation, terminal operations, engineering, and planning and construction of marketing facilities.

Jack Hildebrand has been named head of the additives group, chemical technical service division, in the Bayway refinery of Humble Oil & Refining Co.'s Esso Standard division, Linden, N. J. **James Villwock,** formerly in New York, has been transferred to Bayway as a senior engineer in the economics and planning group, chemical technical service division. **Lowell Ballenger,** formerly with Esso Research & Engineering Co., has been named a staff engineer in the instrument technical service division, Bayway.

Richard J. Lawson, petroleum engineer with El Paso Natural Gas Products Co., has been transferred to Rock Springs, Wyo., from Midland, Tex.

Roy Curnow, Union Oil Co. foreman, has been promoted to superintendent in Coalinga, Calif., succeeding **Francis Barker. Don Craggs,** foreman, has been named superintendent of Union's East Los Angeles basin district. **Clifford Dunham,** formerly in Santa Maria, Calif., has been named foreman in Coalinga.

Maurice Martin, formerly with Schlumberger Well Surveying Corp., has joined Geopetrole of Paris as executive vice president. The consulting company specializes in formation evaluation and reservoir engineering.

Jerry F. D'Arcy, vice president in charge of Arrow Drilling Co.'s Canadian operations since 1955, has been elected president of the newly organized Arrow Drilling Co., Ltd., a subsidiary of Westates Petroleum Co. Headquarters will be in Calgary.

Brunner C. Barnes and **Robert R. Click,** both formerly with Mobil Oil Co. in Dallas, have formed Barnes & Click, engineering firm specializing in consultation and design work for natural gas production and processing. Headquarters will be in Dallas. Barnes was chief process design engineer for Magnolia Petroleum Co.'s natural gas department, Dallas, before the Magnolia-Mobil Oil merger. Click was senior operations control engineer in Magnolia's natural gas department.

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a brief illness. Jones was also vice president of Trojan Oil & Gas Co. and Lotus Oil Co., Corpus Christi.

Albert M. Marcell, 65, Decatur, Ill., oil operator, died January 19 in a Durham, N. C., hospital. Marcell was formerly president of Jarvin Brothers & Marcell, Inc., independent firm in the Illinois basin area.

Richard W. McKeen, 39, regional manager of Skelly Oil Co.'s Skelgas division in Prairie Village, Kans., died January 17 in Denver while attending a sales convention there.

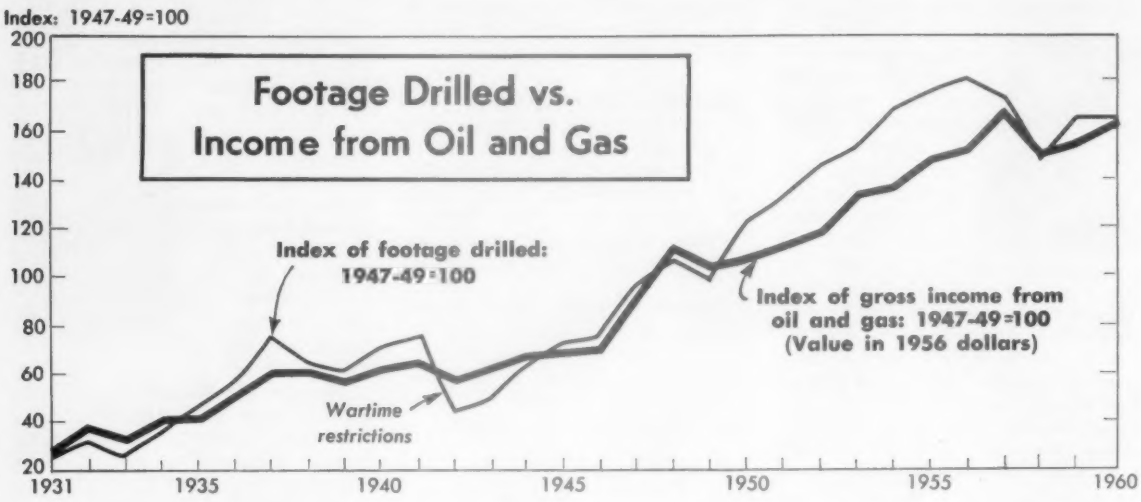
Charles Elmo Batien, 44, general manager in Costa Rica for Drilling & Exploration Co., died January 17 after a heart attack. He had been in Costa Rica 3 months.

Lourin Allen Crum, 54, Colorado independent operator and geologist, died January 25 in a Boulder, Colo., hospital after a long illness.

J. W. Countryman, Jr., 60, co-owner of Countryman Oil Co., Tulsa, and president of the Oklahoma Oil Jobbers Association, died January 24 at his home in Tulsa.

Clarence Allen Keller, 73, retired vice president in charge of sales and marketing for Derby Refining Co., died January 22 in a Wichita hospital. Keller was with Western Refining Co. when that company was purchased by Derby Refining in 1920. He had been a special representative for Derby since his retirement in 1955.

A. A. Kennedy, 64, an assistant superintendent for Mobil Oil Co. in Bakersfield, Calif., died January 20 after a heart attack. Kennedy had been with General Petroleum and Mobil Oil for 38 years.



Footage is back in line with income

BY JOHN C. CASPER

FOOTAGE DRILLED per dollar income from oil and gas in 1960 will be about the same as it was in the 1947-49 period. But, the ratio will be down from the records set from 1950 through 1956.

Reports from operators all over the country indicate a drilling program of about 209,400,000 ft. for 1960. This total represents an increase of better than a million feet over total footage drilled in 1959, despite a slight reduction in the total number of wells scheduled.

Part of the variation between footage and wells is due to two important changes for 1960. Wildcats will represent a larger percentage of total drilling in 1960 than in 1959, and much of the decrease in development drilling will be in the shallow areas.

The chart used with the drilling forecast for 1960 compared well completions with income from oil and gas (OGJ, Jan. 25, p. 146). The chart on this page compares footage with income from oil and gas.

A few adjustments have to be made before footage can be plotted against income. Here are the qualifications.

Income is gross receipts from oil and gas at the well. No deductions were made for royalty payments since the corrections would have cut each year's total by the same number of percentage points.

Footage, used to measure drilling, is a constant unit. Gross income for a year is measured in dollars, and the amount of goods a dollar will buy varies from year to year. Therefore, the gross-income series was corrected for inflation with the wholesale price index for all commodities other than farm products and food. Values are in terms of 1956 dollars.

In order to compare dollar values and feet of hole, the two series were expressed as indexes with average values for 1947, 1948, and 1949 equal to 100.

If there is no abnormal flow of outside capital into the drilling industry from the outside and no unusual withdrawal of funds for other operations, then footage drilled will vary with income from sales of oil and gas.

For the period from 1931 through 1949, the chart shows two short periods of variations in drilling from the income trend. The Government placed definite restrictions on drilling during the early years of World War II. And, big discoveries with wild development programs in the thirties pulled in some outside capital. Completions jumped 82% between 1934 and 1937.

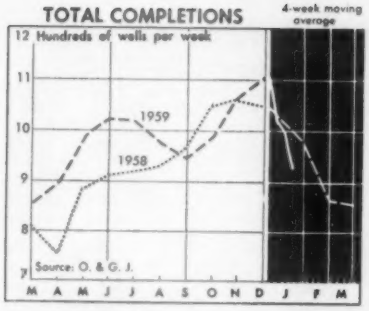
For the period from 1950 through 1956, the chart shows drilling running well ahead of gross income. There has been no way to measure the flow of outside capital into drilling during that period, but there were reports of enough movie-star type of investment to boost total footage.

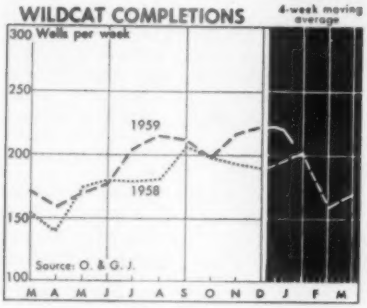
We may be back in a period where the investor is really looking for oil.

Correction: In the forecast of drilling for 1960 (OGJ, Jan. 25, page 147) transpose West New Mexico and wildcat wells with East New Mexico and wildcats.

A quick look at the highlights

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,189,980	UP	10,650	DOWN	112,430
Crude stocks	250,013,000	UP	1,103,000	DOWN	10,121,000
Completions	836	DOWN	282	DOWN	152
Refinery runs	8,227	DOWN	75	DOWN	84
Gasoline stocks	199,905,000	UP	3,391,000	UP	7,022,000
Kerosine stocks	25,866,000	DOWN	717,000	UP	4,478,000
Distillate stocks	132,638,000	DOWN	5,901,000	UP	32,236,000
Residual stocks	50,089,000	DOWN	1,147,000	DOWN	9,835,000
Four-product stocks	408,498,000	DOWN	4,374,000	UP	33,901,000
Total imports	1,809,800	UP	30,000	UP	242,800





Active Rotary Rigs

	1-25-60	1-18-60	1-26-59
Alabama	5	5	8
Arkansas	11	14	7
Arizona	0	0	0
California	67	68	79
Land	61	62	74
Offshore	6	6	5
Colorado	29	30	23
Florida	2	1	1
Land	1	1	1
Offshore	1	0	0
Illinois	18	31	39
Indiana	3	3	4
Iowa	1	1	3
Kansas	100	111	109
Kentucky	8	6	5
Louisiana	287	282	297
North	32	28	36
S. Inland waters	114	107	130
S. Land	85	92	97
Offshore	56	55	34
Maryland	0	0	2
Michigan	36	32	11
Mississippi	72	70	62
Missouri	1	1	0
Montana	15	13	18
Nebraska	16	21	25
Nevada	0	0	0
New Mexico	97	94	100
New York	0	0	0
North Dakota	24	20	29
Ohio	4	4	4
Oklahoma	169	169	176
Oregon	0	0	0
Pennsylvania	14	13	9
South Dakota	4	5	0
Texas	553	539	694
S. Inland waters	7	5	7
S. Land	157	163	139
Offshore	0	0	1
North-East	113	109	157
West Central	181	168	251
West	95	94	139
Utah	28	27	28
Washington	1	1	1
West Virginia	4	4	2
Wyoming	54	52	57
Total U. S.	1,623	1,617	1,793
Western Canada	241	231	217
Eastern Canada	4	4	0
Grand total	1,868	1,852	2,010

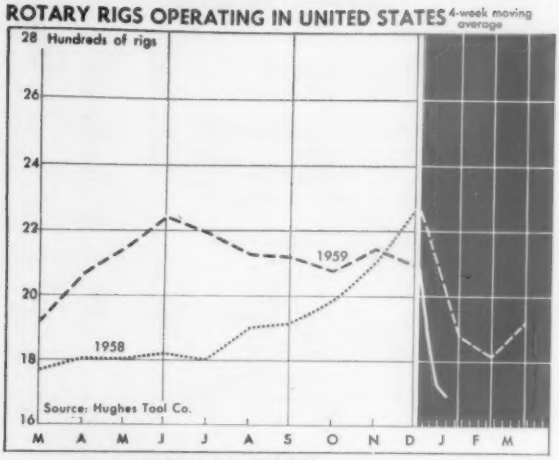
Hughes Tool Co. report.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 23, 1960

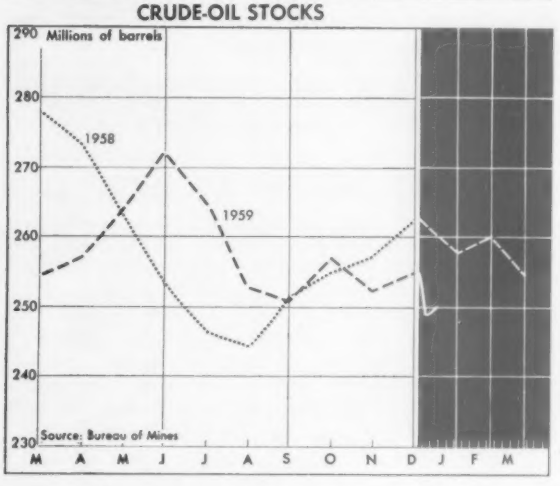
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	3	14	0	0	0	0	0	0	2
Arizona	0	0	0	0	0	0	0	5	.....	0	0	0	0	0	5	.....
Arkansas	7	4	0	1	2	0	24,439	39	71	0	0	0	0	0	10	21
California	22	15	0	4	3	0	102,689	122	125	4	0	0	1	3	30	31
Colorado	15	4	0	1	10	0	74,510	48	60	6	0	0	0	6	27	31
Illinois	74	35	0	1	38	0	158,013	163	190	22	1	0	0	21	39	34
Indiana	16	5	0	0	11	0	21,775	66	58	6	0	0	0	6	23	16
Kansas	83	36	0	4	41	2	287,504	242	339	28	3	0	0	25	78	85
Kentucky	76	59	0	1	15	1	63,757	172	122	12	1	0	0	11	23	8
Louisiana	42	19	4	1	18	0	371,226	249	283	6	0	0	0	6	34	49
North	8	3	0	0	5	0	25,111	79	107	4	0	0	0	4	16	26
South	24	10	4	1	9	0	251,959	127	147	2	0	0	0	2	17	22
Offshore	10	6	0	0	4	0	94,156	43	29	0	0	0	0	0	1	1
Michigan	18	6	0	1	11	0	54,638	59	40	6	0	0	0	6	20	11
Mississippi	11	5	0	0	6	0	126,104	57	65	3	0	0	0	3	21	35
Montana	5	3	0	0	2	0	19,579	19	24	2	0	0	0	2	10	5
Nebraska	18	5	0	0	13	0	101,485	58	41	7	1	0	0	6	23	19
New Mexico	27	17	2	3	5	0	118,788	151	110	5	1	0	0	4	18	16
West	12	6	2	3	1	0	55,820	55	.....	1	0	0	0	1	3	.....
East	15	11	0	0	4	0	62,968	96	.....	4	1	0	0	3	15	.....
New York	0	0	0	0	0	0	0	25	33	0	0	0	0	0	2	1
North Dakota	6	5	0	0	1	0	44,867	23	29	1	0	0	0	1	5	8
Ohio	9	6	0	0	2	1	25,031	106	51	0	0	0	0	0	3	2
Oklahoma	101	48	0	14	37	2	417,199	262	408	15	2	0	1	12	51	78
Pennsylvania	0	0	0	0	0	0	0	6	0	0	0	0	0	0	2	0
South Dakota	0	0	0	0	0	0	0	2	.....	0	0	0	0	0	2	.....
Texas	281	155	10	7	106	3	1,207,147	1,335	1,537	35	3	0	0	52	284	320
Dist. 1	23	8	1	1	13	0	66,501	102	133	8	0	0	0	8	37	30
Dist. 2	12	3	1	0	8	0	93,187	64	71	3	0	0	0	3	16	19
Dist. 3	12	4	0	0	8	0	72,305	130	86	1	0	0	0	1	22	28
Dist. 4	18	2	4	0	12	0	109,925	141	128	4	0	0	0	4	36	40
East	23	19	1	1	2	0	105,630	112	87	2	0	0	0	2	30	26
Dist. 7-B	31	13	1	1	16	0	111,073	153	197	9	1	0	0	8	50	62
West	94	74	0	2	18	0	443,321	365	454	13	1	0	0	12	46	55
Dist. 9	52	19	1	2	27	3	143,987	221	273	13	1	0	0	12	43	49
Dist. 10	16	13	1	0	2	0	61,218	47	108	2	0	0	0	2	4	11
Utah	8	5	0	0	3	0	42,855	18	22	4	1	0	0	3	8	6
West Virginia	0	0	0	0	0	0	0	45	53	0	0	0	0	0	1	2
Wyoming	17	8	0	4	5	0	81,392	64	60	8	3	0	0	5	34	22
Miscellaneous	0	0	0	0	0	0	0	12	9	0	0	0	0	0	11	7
Total U. S.	836	440	16	42	329	9	3,342,998	3,351	3,744	190	16	0	2	172	764	809
Previous week	1,118	567	35	73	395	48	4,686,451	.....	.....	238	24	4	8	202	.....	.....
Cum. 1960	3,351	1,580	139	239	1,299	94	14,737,179	.....	.....	764	64	10	18	672	.....	.....
Cum. 1959	3,744	1,840	95	227	1,489	93	15,876,743	.....	.....	809	76	12	27	694	.....	.....
Western Canada	53	33	0	6	14	0	299,770	88	74	14	3	0	3	8	21	17

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	1-16-60	1-9-60	1-17-59
Pennsylvania	2,263	2,293	2,584
Other Appalachian	2,024	2,101	1,485
Illinois, Indiana, Michigan	9,783	9,787	10,190
Nebraska and North Dakota	2,679	2,826	2,208
Kansas	9,905	9,552	9,652
Oklahoma	17,089	16,853	16,705
Arkansas	2,254	2,084	2,105
Louisiana	18,289	17,516	17,423
North	3,194	3,304	3,140
South	15,095	14,212	14,283
Mississippi, Alabama, Florida	2,606	2,531	2,364
New Mexico	8,105	7,992	8,684
Texas	106,651	106,408	115,419
East Texas	7,785	8,051	8,278
West Texas	50,171	49,328	56,722
Texas Gulf	19,167	19,603	20,095
Other Texas	29,528	29,426	30,324
Wyoming	16,801	16,933	13,853
Other Rocky Mountain	9,464	9,686	9,420
California	28,511	29,021	34,037
Foreign	†13,589	13,327	14,005
Total	**250,013**	248,910	260,134

*Bureau of Mines. †Includes 3,606,000 bbl. in California.

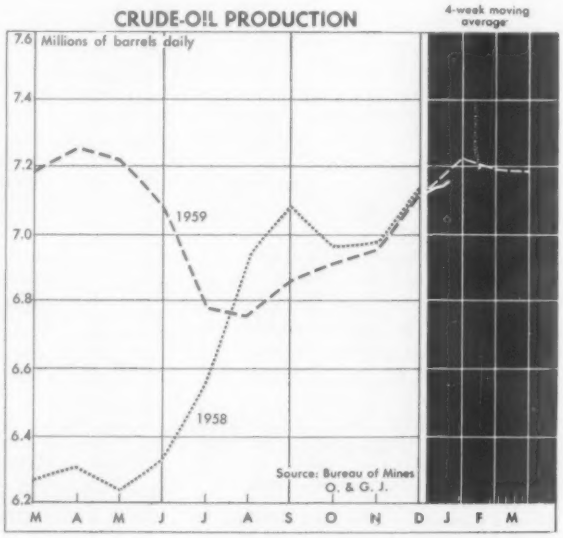
DAILY AVERAGE PRODUCTION FOR WEEK

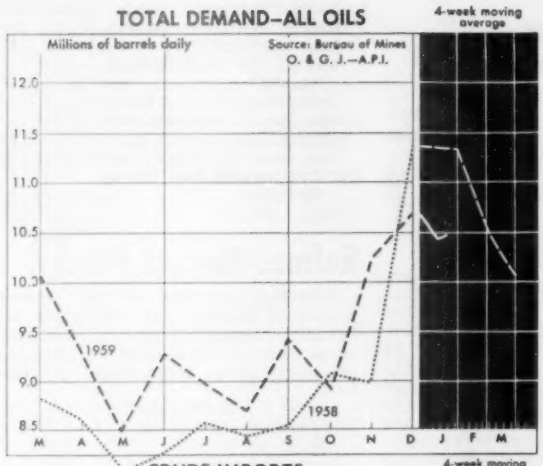
	January 23, 1960			January 16
	Crude oil	Lease condensate	Total	total
Alabama	16,400	.....	16,400	15,500
Arkansas	80,300	200	80,500	81,650
California	835,100	.....	835,100	834,500
Colorado	129,100	.....	129,100	129,500
Eastern	41,600	.....	41,600	42,000
Florida	1,150	.....	1,150	1,150
Illinois	217,200	.....	217,200	221,700
Indiana	31,800	.....	31,800	31,800
Kansas	†317,360	.....	†317,360	†328,110
Kentucky	75,100	.....	75,000	75,000
Louisiana	947,800	123,500	1,071,300	1,069,900
North	107,800	6,000	113,800	112,400
South	840,000	117,500	957,500	957,500
Michigan	33,000	.....	33,000	32,300
Mississippi	141,850	4,870	146,720	146,720
Montana	81,400	.....	81,400	82,000
Nebraska	62,700	.....	62,700	63,800
Nevada	100	.....	100	100
New Mexico	292,600	6,800	299,400	299,400
North Dakota	59,000	.....	59,000	58,700
Oklahoma	†570,600	.....	†570,600	†546,000
Texas	2,584,000	81,000	2,665,000	2,665,000
Dist. 1	40,000	3,000	43,000	43,000
Dist. 2	112,000	8,900	120,900	120,900
Dist. 3	340,000	37,000	377,000	377,000
Dist. 4	179,000	9,800	187,800	187,800
Dist. 5	27,000	400	27,400	27,400
Dist. 6	111,000	9,400	120,400	120,400
East Texas field	142,000	.....	142,000	142,000
Dist. 7-B	135,000	180	135,180	135,180
Dist. 7-C	123,000	3,620	126,620	126,620
Dist. 8	1,074,000	5,200	1,079,200	1,079,200
Dist. 9	193,000	2,100	195,100	195,100
Dist. 10	108,000	1,400	109,400	109,400
Utah	111,400	.....	111,400	109,900
Wyoming	343,700	.....	343,700	344,200
Others	‡450	.....	‡450	‡400
Total U. S.	6,973,610	216,370	**7,189,980**	7,170,330
Change from prev. week up	.....	.....	**10,650**	.....
Canada	†627,700	.....	†627,700	†620,400

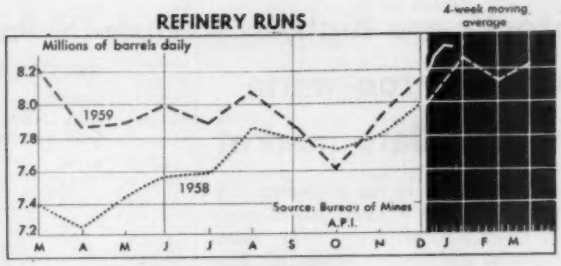
Total U. S. Prod.-Jan. 1-Jan. 23 ..... 164,899,800 bbl.
Same period last year (crude plus cond.) ..... *166,071,939 bbl.

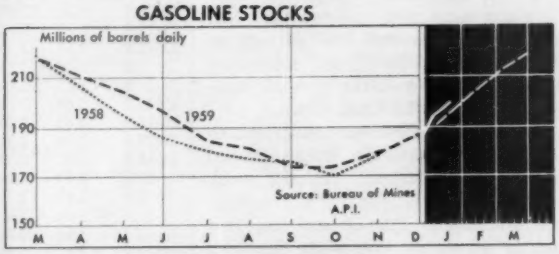
*Includes 4,917,425 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota and Washington.

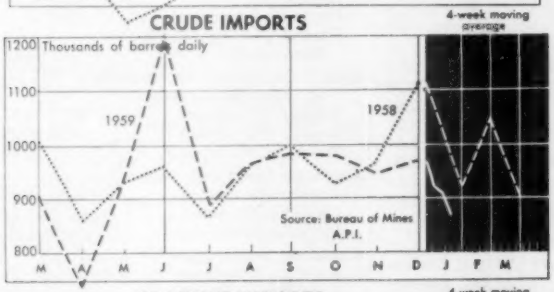
CRUDE-OIL PRODUCTION

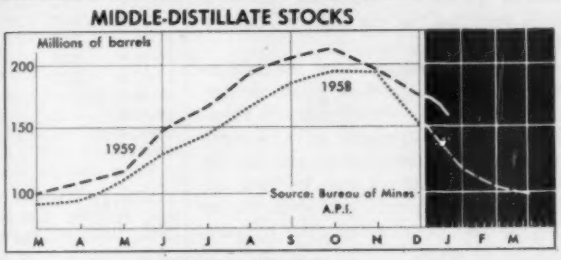


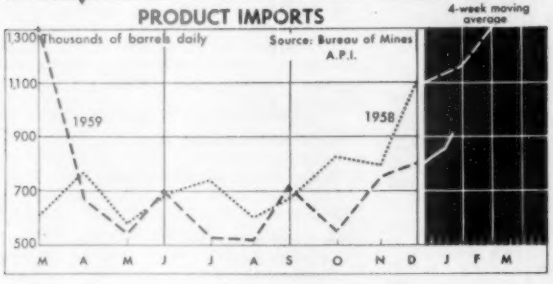


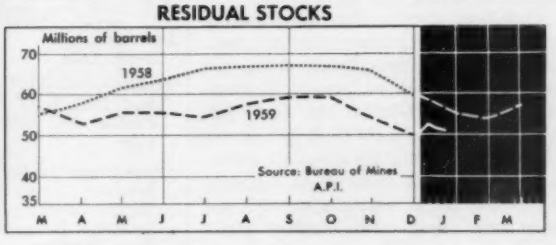












API REFINERY REPORT—JANUARY 22, 1960

(Thousands of Barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, January 1959: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,117	488.0	48.0	363.7	146.1	40,825	11,210	51,035	12,773	1,195	550.9	45.4	416.3	225.8
Appalachian:														
District 1	106	39.0	4.3	21.0	20.0	6,078	726	3,436	309	97	39.7	6.5	21.5	11.9
District 2	113	55.4	9.0	18.0	16.7	3,179	490	1,544	410	114	57.4	7.3	20.0	18.6
Ind., Ill., Ky.	1,552	802.6	78.9	373.4	210.3	36,507	5,408	22,467	5,426	1,512	738.9	80.0	359.6	223.2
Minn., Wis., Dak.	124	55.3	8.7	28.0	18.6	7,442	983	6,127	642	108	52.4	6.4	28.4	14.6
Okla., Kans., Mo.	747	402.6	12.1	206.7	24.9	19,509	1,062	10,836	1,146	770	416.0	22.7	210.0	40.8
Inland Texas	293	208.6	11.7	52.1	19.1	7,708	442	1,673	2,401	278	183.9	8.8	48.3	21.7
Texas Gulf Coast	1,913	998.1	151.4	452.0	142.9	25,568	2,291	14,279	4,928	1,961	979.2	142.9	564.9	182.2
La. Gulf Coast	698	348.4	77.9	148.7	53.6	11,989	1,974	5,001	1,090	699	343.6	81.2	184.5	50.4
N. La. and Ark.	112	42.3	8.3	22.9	10.7	5,144	624	1,991	216	92	45.3	5.8	19.1	5.8
Rocky Mountain:														
New Mexico	24	13.4	0.7	4.7	2.1	893	59	198	96	24	11.3	0.6	4.6	2.4
Other R'cky Mt.	294	140.3	3.3	67.9	33.3	6,302	178	2,318	1,089	287	136.4	4.2	62.8	37.5
West Coast	1,134	513.6	6.1	190.0	244.0	28,761	419	11,733	19,563	1,093	502.5	6.9	193.0	281.9
Jan. 22, 1960	8,227	4,107.6	420.4	1,949.1	942.3	199,905	25,866	132,638	50,089	8,230	4,057.5	418.7	2,133.0	1,116.8
Jan. 15, 1960	8,302	4,154.9	389.1	§1,952.4	1,018.1	196,514	26,583	138,539	51,263	....	.....	.....	.....	.....
Jan. 23, 1959	8,311	4,014.4	352.1	2,144.1	1,111.3	192,883	21,388	100,402	59,924	....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Revised.

Stocks are high, weather too warm, for distillate market

MARKETS are in the midwinter doldrums. No one is interested in gasoline other than on a day-to-day basis. Northern and eastern states are having some snow and cold weather, but temperatures are not low enough to cause any rebuilding of secondary storage. The low-sulfur residual market is firm on the Gulf Coast.

In the Mid-Continent and North Central area gasoline stocks gained almost 2,000,000 bbl. for the week ended January 22. The total is 4,000,000 bbl. higher than it was last year and is about in line with the high level reported for the end of January 1958.

It is this pressure from inventories that holds spot gasoline prices at current low levels. Pipeline-grade regular gasoline is available at 9.50 cents a gallon for interrefinery sales on the Group 3 market. Large jobbers are buying at 9.75 cents, and some of the low-volume distributors may be paying 10.00 cents.

Distillate stocks also are running high in this refining-marketing area. Total distillate inventories amounted to 39,430,000 bbl. on January 22 compared with 30,903,000 bbl. last year. A total of near 30,000,000 bbl. seems to be about normal for distillate stocks in this district at the end of January, based on actual inventories reported in recent years. The current stock level is too high by about 8,000,000 bbl.

It will take cold weather or reduced production to get distillate stocks down to normal by the end of the heating season. The refiner has control of one remedy but can't do a thing about the other.

Residual stocks for the Mid-Continent and North Central areas are a little above the average for recent years but not enough to disturb prices.

Distillate stocks in the Gulf-East Coast districts are about 22,000,000 bbl. above totals at this time last year and may be slightly above the record reported in 1958.

Last year's totals were on the low side of the normal range, but current inventories are definitely on the high side. This excess may account for the rumors of offers to deliver several cargoes of No. 2 fuel to New York Harbor at very low prices.

Suppliers on the East Coast also need several weeks of cold weather.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 1-11-60.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.55
Middle District	4.37
Southwest Pennsylvania	4.10
West Virginia	3.92
Buckeye Grade	3.97
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	9.75-10.00
Premium (99 octane)	12.25-12.75
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
Premium (98 octane)	11.75-12.00
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.25-10.50
Diesel oil (58 d.i. and above)	10.00
Distillate No. 1	10.00-10.25
Distillate No. 2	9.25
Gulf Coast (cargoes):	
Kerosine 41-43	9.50
Distillate No. 2	8.625
New York Harbor (barges):	
Kerosine 41-43	11.10
Distillate No. 2	10.10
Diesel fuel, 48-52 d.i.	10.40
Caribbean area (cargoes):	
Distillate No. 2	8.375-8.625

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$1.80-1.90
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-USNH, clean (ATRS—10%)	$2.57
★ Gulf-USNH, dirty (ATRS—30%)	2.00
★ Carib.-USNH, dirty (ATRS—55%)	1.24
★ Carib.-UK, dirty (Scale—60%) (13s. Od.)	1.82
★ Sidon-USNH, dirty (USMC—60%)	3.12

★ Denotes change from previous week.

(Continued from page 171)

45°, Chester 5,307-08, 5,328-30, 5,354-56 ft. TD 5,620 ft.

Pawnee County: Petroleum, Inc., 1 Rice "B," SE SE NE 12-23s-15w. IP 57 BOPD, 40°, Arbuckle 4,332-38 ft. TD 4,038 ft. Opens Rice field.

Phillips County: Don Peaker 1 Van Dyke, C NE SW 1-2s-19w. IP 10 BWPD, 5 BOPD, 36°, Lansing-Kansas City 3,477-3-596 ft. TD 3,680 ft. Opens Van Dyke field.

KENTUCKY

Webster County: C. Sherman 2 Williams, 18-M-20. IP 4 BOPD, Penn. sand 537-549 ft. Opens Williams field.

MONTANA

Rosebud County: Vaughey & Vaughey 1 Kincheloe, NW SW 35-11n-32e. IPP 145 BOPD, Tyler discovery, new field, 4,957-65 ft. TD 5,130 ft.

EASTERN NEBRASKA

Red Willow County: Frontier 1 Reiners, C NW SW 14-2n-28w. IP 122 BOPD, Lansing-Kansas City 3,273-3,310 ft. TD 3,545 ft. New field.

NEBRASKA

Banner County: Pile field discovery. Petro-Lewis, Ltd., et al. 1 Pile, SW NE 12-17n-55w. IPP 220 BOPD, plus 5% water. "J" sand discovery, new field. TD 6,205 ft.

Petroleum Inc. 1 Blake-G, C SW SE 15-17n-56w. IPP 204 BOPD, 1% water plus, "J" sand discovery, new field. TD 6,715 ft.

Kimball County, Evertson pool: Enbrook Oil & Gas Co. 1 Evertson, C SE NW 12-16n-57w. IPP 152 BOPD, "J" sand discovery, new field. TD 6,787 ft.

NEW MEXICO

Chaves County: Hershel Copeland 1 Franklyn, 35-14s-27e, 8 miles southeast of Hagerman. IPP 40 BOPD, 43°, San Andres 2,030-2,153 ft.

Lea County: Carper Drilling Co., Inc., 1-A Federal "MA," 31-17s-33e, 8 miles southeast of Maljamar. IP 432 BOPD, ½-in. choke, 37°, GOR 780:1, TP 350 psi., Abo 8,582-8,748 ft. TD 10,015 ft., PB 8,674 ft. Elevation 4,009 ft.

Reeves County: T. M. Evans 1 Davis, Sec. 28, Blk. 57, T-1, T&P Sur., 9 miles north of Orla. Recompletion. IPP 10 BOPD, 39°, Delaware 2,764-80 ft. TD 2,918 ft.

Rio Arriba County: El Paso Natural Gas Co. 27-20 San Juan Unit 30-5, SW SW 20-30n-5w. IPF Mesaverde 2,358 M.c.f.d., ¾-in. choke; IPF Dakota 1,309 M.c.f.d., ¾-in. choke. Dakota 7,646-72 ft., Mesaverde 5,162-5,644 ft. TD 7,890 ft., Dakota discovery, new pool.

Roosevelt County: H. L. Brown, Jr., and Clem E. George 1 Federal, 33-7s-37e. IP 2,552 M.c.f. of gas, 92 bbl. condensate, 76°, GOR 26,856:1, TP 2,050 psi., Wolfcamp 8,022-8,124 ft. TD 8,762 ft. Elevation 4,061 ft.

Bill Roden 1 Federal-Selman, 24-8s-36e, 11 miles northeast of Crossroads. IP 216 BOPD, ¾-in. choke, TP 200 psi., Pennsylvanian 9,632-52 ft. TD 9,714 ft. Elevation 4,071 ft.

San Juan County: Blackwood & Nichols 58-13 Northeast Blanco Unit, NE NE 13-31n-7w. IPF Dakota 2,461 M.c.f.d., 2-in. choke: IPF Mesaverde 6,270 M.c.f.d., 2-in. choke. Mesaverde 5,421-5,864 ft.; Dakota 7,987-8,102 ft. TD 8,127 ft. Dakota discovery, new field.

Tennessee Gas Transmission Co. 1 Eaton Gas Unit, SW SW 25-29n-11w. IPF 4,791 M.c.f.d., Dakota 6,173-6,344 ft. Dakota discovery, new field. TD 6,442 ft.

M. J. Brannon, Jr., 28-1 Federal, SW NE NE 28-25n-9w. IPF 3 M.M.c.f.d., and 28 BDPD, Dakota discovery, new field. TD 6,498 ft.

Southwest Production Co. 1 Callow-Federal, NE SE 33-29n-13w. IPF Dakota 4,760 M.c.f.d., ¾-in. choke; IPF Gallup 193 BOPD, 18/64-in. choke. Gallup 5,164-5,266 ft. Dakota discovery, new field. TD 6,070 ft.

Ward County: Chambers & Kennedy and Gulf Oil Corp. 1 Sealy & Smith Foundation, Sec. 29, Blk. A, G&MMB&A Sur., 14 miles southeast of Kermit. IP 216 BOPD, 14/64-in. choke, 44°, GOR 1,060:1, TP 525 psi., Clear Fork 5,650-71 ft. TD 13,267 ft., PB 5,690 ft.

Gulf Oil Corp. 6 Wristen Bros., Sec. 18, Blk. 5, H&TC Sur., 3 miles northeast of Grandfalls. Recompletion. IPP 51 BOPD, 34°, GOR 3,331:1, Devonian 6,265-6,325 ft. TD 7,080 ft.

NORTH DAKOTA

McKenzie County: Shell Oil Co.-Northern Pacific Railway Co. 32-15 NP, SW NE 15-145n-101w. IPF 1,526 BOPD, 65 BWPD, 4% cut, 32/64-in. choke, TP 745 psi., GOR 1,125:1, 32.8°. Mission Canyon discovery at 9,399 ft. New field. TD 9,535 ft. Opens Rough Rider field.

OKLAHOMA

Beaver County: Panhandle Development Co. 1 Helfenbein, C SW NE 10-1n-20eCM. IPF 605 M.c.f.d., Chester 7,698-7,707, 7,719-33, 7,753-59, 7,818-24 ft. TD 7,890 ft.

Gulf Oil Corp. et al. 1 R. Penner, SE NW 22-2n-20eCM. IPF 106 BOPD, 33°, Morrow 6,955-88 ft. TD 7,504 ft. New field.

Comanche County: Woods Petroleum Corp. 1 Hix, SE SE 21-3n-9w. IPF 2,950 M.c.f.d., Morrow 6,322-26 ft. TD 6,915 ft.

Dewey County: Union Oil Co. of California 1 Robertson, NE SW 9-16n-17w. IPF 2,500 M.c.f.d., Oswego lime 9,532-94 ft. TD 10,118 ft.

Sinclair 1 Carl King Unit, C SW NE 23-16n-17w. IPF 186 BOPD, 2,061 M.c.f.d., 40°, Oswego 9,664-9,715 ft. TD 9,762 ft.

Amerada Petroleum Corp. 1 M. Brewer, C NE SW 23-18n-18w. IPF 3,238 M.c.f.d., Morrow 10,302-32 ft., Chester 10,358-78 ft. TD 10,600 ft.

Ellis County: King-Stevenson 1 Thompson, NE NW NE SW 1-23n-23w. IPF 9 M.M.c.f.d., Morrow 7,902-58 ft. TD 8,124 ft.

Grant County: Sinclair 1 John C. Giesel Unit, C NW SE 11-27n-8w. IPF 1 BOPD, 5,026-40 ft. 31°. TD 5,127 ft. West Mt. Zion field.

Harper County: Pure Oil Co. 1 G. B. Crawford "B," C SE NW 26-26n-24w. IPF 8,170 M.c.f.d., Hoover 4,329-31, 4,337-41, 4,345-66 ft.; Tonkawa 5,578-88 ft., 5,591-5,600 ft. TD 7,173 ft.

Kay County: Toto Gas Co. 1 Hardin, SW SE SW 9-26n-1e. IP 59 BOPD, 84 BWPD, 42°, Red Fork 3,938-58 ft. TD 4,128 ft.

Earlsboro Oil & Gas Co. 1 Dora Goodson, SW SW NW 11-26n-1e. IP 175 BOPD, 108 BSWPD, 40°, Red Fork 3,824-38 ft. TD 3,996 ft.

Major County: Livingston Oil Co. 1 Montgomery, SE SE NW 6-21n-9w. IP 7 BOPD, Manning 6,805-10 ft., 6,817-22, 6,827-37 ft. TD 7,165 ft.

Livingston and Oklahoma Natural Gas Co. 1 B. H. York, NE NE SW 13-22n-11w. IPF 4 M.M.c.f.d., Manning 6,744-80 ft. TD 6,862 ft.

Noble County: Powell Drilling Co. et al., NE NE SE 30-22n-2w. IP 6 BOPD, 34°, Hotzon 1,330-50 ft. TD 1,350 ft.

Woods Petroleum Co. 1 Back, C NE SE 28-24n-2w. IP 45 BOPD, Miss. Chat, 4,427-41 ft. TD 4,441 ft. 40°.

Pittsburg County: Carter Oil Co. 1 Ossie Morris, SE SE NW 24-5n-12e. IPF 3,661 M.c.f.d., Hartshorne 3,216-3,378 ft. TD 3,445 ft.

Woods County: Cities Service Oil Co. 1 Whiteneck, NE NE SW 28-24n-13w. IPF 10 M.M.c.f.d., TD 6,407 ft.

Calvert 1 Romjie, SE NW 31-27n-15w. IPF 13,875 M.c.f.d., Tonkawa 4,893-4,928 ft. TD 5,919 ft.

Woodward County: Ashland Oil & Refining Co. 1 Shoreline, C NE SW 34-21n-17w. IPF 3,500 M.c.f.d., Chester 7,952-60 ft., 7,966-80 ft. TD 8,147 ft.

Pure Oil Co. 1 Selman Unit, SW SW SE 2-26n-19w. IPF 1,300 M.c.f.d., Tonkawa 5,016-20 ft. TD 6,161 ft.

TEXAS GULF COAST

Brazoria County: Texaco Inc. 33-B. W. T. Belcher, H. N. Little Sur., A-319, 2 miles northeast of Manvel. IP 115 BOPD, 8/64-in., 25.1°, GOR 137 cu. ft. per bbl., TP 435 psi., perf. 4,125-31 ft., basal Miocene. TD 4,310 ft. New pay in Manvel field.

Gulf Oil Corp. 1 Minnie Holland et al. Unit, George Robinson Sur. 3, A-126, 2 miles southwest of Anchor. AOF 3,150 M.c.f.d., GLR 127 M.c.f. per bbl., 42.9°, shut-in TP 6,384 psi., perf. 10,543-48 ft., Frio. TD 11,068 ft. New pay in Blue Lake field.

Goliad County: Rehler-Carlson et al. 1 Arthur Weise, Jose Maria Mancha Sur., A-203, 5 miles southwest of Weesatche. AOF 15,100 M.c.f.d., GLR 103 M.c.f. per bbl., 53.2°, shut-in TP 1,695 psi., perf. 4,361-78 ft., Pettus. TD 4,445 ft. New pay off north side of Melrose (Wilcox) field.

NORTH TEXAS

Cooke County: John E. Kirkpatrick 2 Florence D. Estes, T. Toby Sur., A-1054, 13 miles northeast of Gainesville. Strawn discovery in Walnut Bend field. IPP 86 BOPD, 31°, sand 5,380-5,401 ft. TD 5,438 ft.

Denton County: Bayview Oil Co. 1 W. T. Evers, M. E. Forrest Sur., A-417, 4 miles east of Denton. IP 5,400 M.c.f.d. of gas, GOR 110,000:1, 50°, shut-in pressure 1,520 psi., Cordell sand 3,663-70, 3,680-86 ft. TD 3,890 ft., ground elevation 560 ft.

TEXAS PANHANDLE

Ochiltree County: Shamrock Oil & Gas Corp. 2 C. H. Kelln, Sec. 919, Blk. 43, H&TC Sur., 6½ miles southeast of Perryton. IPCAOF: 2,050 M.c.f.d., Mississippian 8,498-8,526 ft. TD 8,756 ft. Gas discovery at Barlow field.

Stekoll Petroleum Corp. 1-123 A. McGarraugh, Sec. 123, Blk. 13, T&NO Sur., 14 miles southeast of Farnsworth in south-central part of county. IPF 162 BOPD, 20/64-in. choke, Cleveland 7,021-37 ft. TD 9,800 ft. OWDD.

WYOMING

Carbon County: Continental Oil Co. 14-1 Government, C NW SE 14-15n-91w. IPF 887 M.c.f.d., 31 BWPD, Deep Creek discovery, new field. TD 2,725 ft.

Crook County: Woodward M. Jones 1 State, NW SW SE 36-50n-66w. IPP 4 BOPD, 37°, Lakota discovery, new field. TD 577 ft.

Johnson County, West Sussex pool: Continental Oil Co. 90 Unit, SW NW 10-42n-79w. IPP 20 BOPD, 34°, 4,154-82 ft., Parkman discovery, new pay. TD 4,800 ft.

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1 NATIONAL T-20 rig complete: WAKBU, torque converter, 87' Moore mast, 7' substructure, 7¼" x 14" FXQ skidmounted with LRO, 4900' good 4½" drillpipe, 12 collars 5¾". 1 Unit 15 rig complete: 2 Climax V-80's, hydromatic, 7¾" x 16" FOFXO compounded, 127' Moore mast, 9' substructure, 7,000' practically new 4½" drillpipe, 18 collars 5¾". Rigs include all extras needed by major companies and are currently working in West Central Texas. Box L-668, The Oil and Gas Journal, Tulsa, Oklahoma.

USED BREWSTER N-4 Torque Converter Rig Complete powered by Waukesha 6WAK Engine, with 93' Moore Mast and 6'-4" high Substructure, Gardner-Denver 7¼" x 12" Pump powered by LeRoi 12-Cylinder Engine, Brewster R-4-30 Traveling Block with BJ 460 Hook, Brewster 4-S Swivel, Brewster OB-18 Rotary, Regan Blowout Preventer, Vibrating Shale Shaker, Complete Accessories, Drill Collars and optional 4" O.D. or 4½" O.D. Drill Pipe. Excellent condition. Priced right. Located Oklahoma City. Lucey Products Corporation . . . 624 South Cheyenne Avenue, Phone LUther 4-4711, Tulsa, Oklahoma.

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BOX L-670
THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

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1—BREWSTER MODEL OB-18 Oilbath Rotary and list of additional equipment, used 360 hours. Location New York. Box L-691, The Oil and Gas Journal, Tulsa, Oklahoma.

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EQUIPMENT WANTED

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TRANSLATORS: Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N.J.

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PETROLEUM GEOLOGIST—Minimum eight years experience, to head small exploration group in Libya for established company. Broad experience in all phases of subsurface exploration, including a sound practical knowledge of surface and geophysical methods. Must be capable of handling and training men. Good opportunity. Immediate opening. Permanent. Box L-695, The Oil and Gas Journal, Tulsa, Oklahoma.

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The Mahutska Oil Company, Robinson, Illinois, is seeking a Petroleum Engineer with college degree and 5 years Tri-State experience. Please reply by letter only, giving name, education, experience, present employment, marital and service status. Address letter to P. O. Box 382, Robinson, Illinois, Attention: Thomas F. Lawry. All replies will be held in confidence.

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Industrial Relations Manager
INTERNATIONAL REFINERIES, INC.
Wrenshall, Minnesota

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SITUATION WANTED

GEOLOGIST: 32, 10 years on and offshore Gulf Coast, Texas, Louisiana and Ark-La-Tex experience including sub-surface, seismic, stratigraphic, evaluation, checking and finding deals. Wide range of contacts. Box L-661, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 33, married, 10 years sales and management experience with oilwell servicing company, seeks sales or management work. Financial participation considered in small agressive company. Box 31 R 499, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif.

GEOLOGIST 17 years experience, foreign and domestic, subsurface, well site geology, scout and engineer. Speak Spanish. Available May. Would consider situation other than geology relation to oil business. Box L-678, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—33, M.S., 8 years foreign and domestic experience. Desires foreign work. Resume on request. Immediate availability. Box L-667, The Oil and Gas Journal, Tulsa, Oklahoma.

THOROUGHLY EXPERIENCED contracts, leases, titles, damages, right of way. Licensed attorney Texas, Oklahoma. Will relocate with producing and/or pipeline organization. Available February First. Box L-662, The Oil and Gas Journal, Tulsa, Oklahoma.

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ECONOMIC ANALYST

Degree, 16 years balanced experience, domestic and foreign. Process design, natural gas, gasoline and refining operations. 4 years supervision engineering economics group—management services, evaluation, process selection, coordination, planning and economic justification of natural gas and petroleum processing facilities. Negotiation and analysis of purchase, sale, processing and joint venture agreements. 3 years coordinator of natural gas and natural gasoline operations with Venezuelan major. Supervision of operation and maintenance, off-shore gas turbine-centrifugal compressor, gas injection and absorption facilities.

710 Wayne Drive
Bakersfield, California

SITUATIONS WANTED

PETROLEUM ENGINEER—34, 11 years production experience. O. U. graduate. Box L-679, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Eleven years with Major Ark., La., Tex., & Miss. desires employment with smaller, more active company. Box L-660, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 41, B.S. Texas A&M., 23 years experience drilling, production, appraisals, evaluations, unitization, secondary recovery, engineering, management positions, presently employed, excellent references, desires management or senior engineering position with chance for advancement. Box L-676, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, M. S., 40. 15 years stratigraphic, structural, subsurface, wellsite, core and surface experience. Publications in U. S., U. K., Australia. Full resume on request. Will travel. Desires position in oil exploration. Box L-648, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—Thirteen years diversified domestic, foreign experience. Excellent references. Box L-668, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN DESIRES position as representative for independent or small company planning to locate in Rocky Mountain Area. Excellent references, many contacts, experience qualifies. Box L-692, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN, 31, experienced in all phases land work, desires responsible position with growing aggresive independent. Resume on request. Box L-696, The Oil and Gas Journal, Tulsa, Oklahoma.

HIGHLY EXPERIENCED, pipeline construction engineer, or superintendent construction. Stations, terminals, design, estimates. Foreign or domestic. Address: 849 South Gramercy Drive, Apt. 207, Los Angeles 5, California. Phone WEbster 1-2023.

TITLE ANALYST or Landman: 26-years experience; titles, lease records. Excellent references. Available now. Will relocate. Ross King, 4943 East 27th. Tulsa 14, Oklahoma.

PETROLEUM ENGINEER, 26, married. BS in petroleum engineering and geology—4½ years experience in production, reservoir engineering, drilling, well completions and workovers. Desires position with consulting or banking firm. Presently employed. Box L-580, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, desires position with independent producer. Presently with major, 2½ years diversified experience. Box L-686, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST—working in Venezuela, 4 yrs. experience in Rockies, Venezuela, A.B., some graduate work, 32, married, 3 yrs. accounting experience, desires relocation U. S. A. in non-geologic capacity. Box L-685, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT GEOLOGY or scouting job. Employed, 25, single, veteran, geology degree and one year related oil field experience. Box L-684, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-GEOPHYSICIST, 31, presently employed. 6½ years experience, major oil company. All phases seismic exploration. Box L-687, The Oil and Gas Journal, Tulsa, Oklahoma.

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FOR SALE—Texas corporation (Oil exploration and drilling) with medium to high six figure tax loss, oil production and 2 excellent rotary rigs. Stockholders wish to sell, though might consider merger. Ideal vehicle for small group with production who wish to expand. Box L-669, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

WELL ESTABLISHED Canadian supply company, situated in Edmonton, Alberta, requires other lines to handle. Reply to: Box L-683, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

FOR SALE in Oklahoma: 2 producing wells on 600-acre block to be developed. Box L-694, The Oil and Gas Journal, Tulsa, Oklahoma.

GOOD GAMBLE—Geology title, ⅞ leases, 720 acres, Sections 9 and 10, T26N, R67W, Platte County, Wyoming. Well to be drilled, Section 21. Quick sale, 500 acres, $7.50 acre. Several prospective pays. Owner: Henry Rochmill, 306 Danciger Bldg., Ft. Worth, Texas.

KENTUCKY—600-acre lease on Willis Creek along Cumberland-Clinton County. Border near many Granville Sand producing wells. Price $10.00 per acre, ⅛ override. Wire or phone. W. V. Cravens, % Alpine Motel, Burkesville, Kentucky.

KENTUCKY— 4,000 acres western Pulaski County, 1,000 acres Russell County, 600 acres southern Casey County, 1,200 acres Monroe County. Price $5.50 per acre, ⅛ override. Box L-693, The Oil and Gas Journal, Tulsa, Oklahoma.

WATERFLOOD PROSPECT—Eastern Kansas. 12 BOPD Settled Production. Core Analyses and Engineering Report. Box L-658, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2,000 acres. Write quickly to: Jefferson G. Smith, 718 Littlefield Building, Austin 15, Texas.

WATER FLOOD Franklin County, Kansas. 640 acres, good engineering and best equipment, modern in every respect. Wonderful potential, good reason for selling. No brokers. Unless you are financially responsible do not reply. Box L-326, The Oil and Gas Journal, Tulsa, Oklahoma.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL AND ALLOTTED INDIAN LANDS, Department of the Interior Bureau of Indian Affairs, Uintah and Ouray Agency, Fort Duchesne, Utah, SEALED BIDS will be received until 2:00 P.M. Mountain Standard Time, February 9, 1960, and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah, for the leasing of 640 acres of Tribal Indian lands, and 987.94 acres of allotted Indian lands, located in Townships 10 and 11 South, Range 20 East, Salt Lake Meridian, Uintah County, Utah, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Uintah and Ouray Indian Agency, at Fort Duchesne, Utah.

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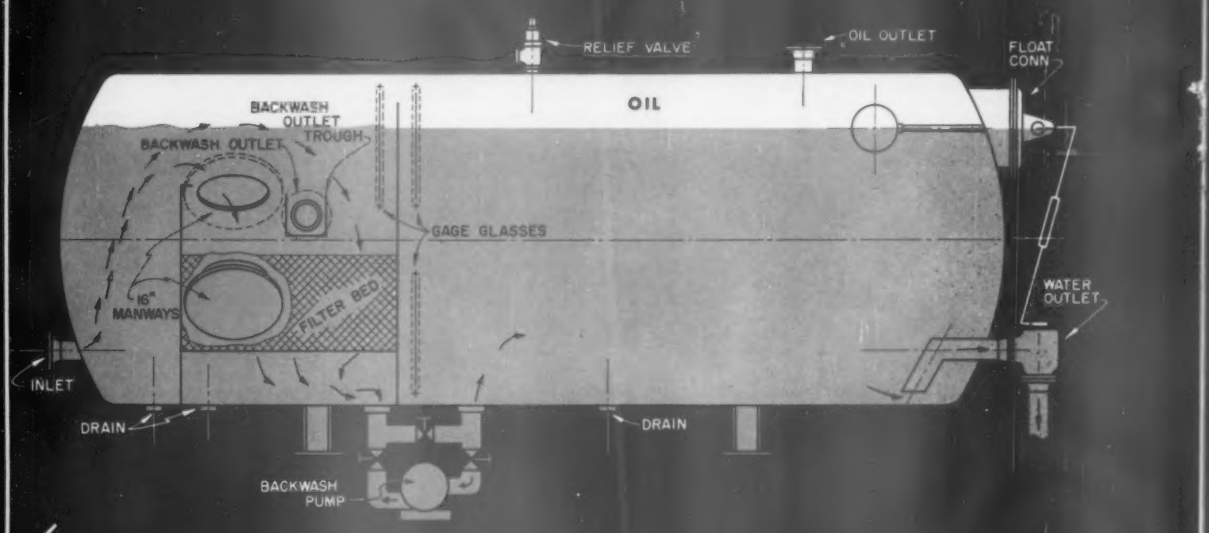

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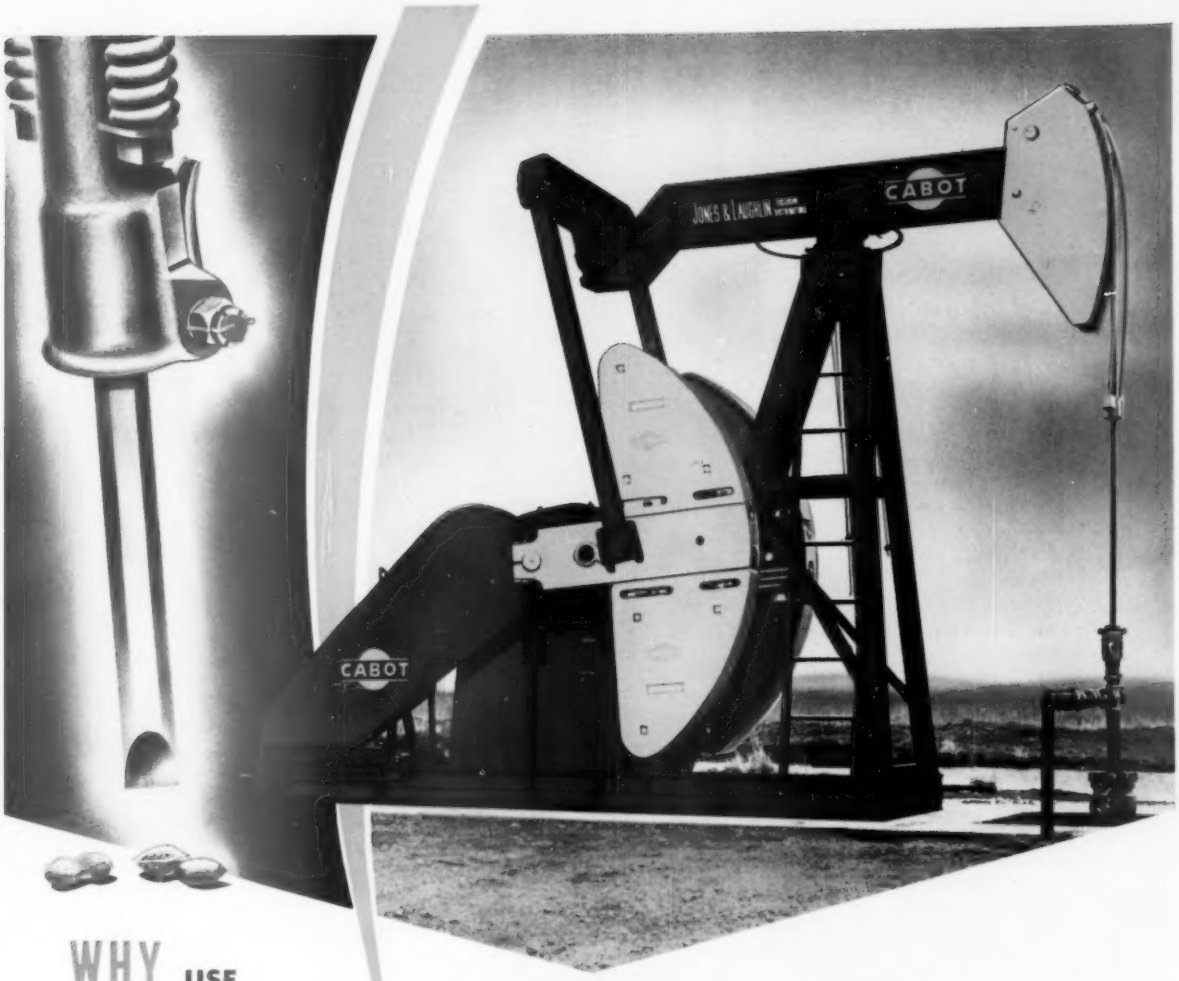

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